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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 960
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 963
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 964
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 965
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 966
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 967
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

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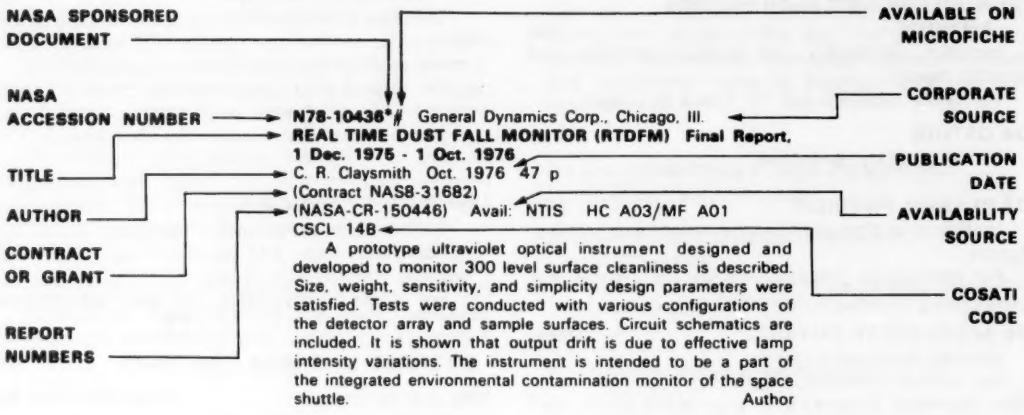
TYPICAL CITATION AND ABSTRACT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N78-10436*# General Dynamics Corp., Chicago, Ill.
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REAL TIME DUST FALL MONITOR (RTDFM) Final Report, 1 Dec. 1975 - 1 Oct. 1976
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PUBLICATION DATE
C. R. Claysmith Oct. 1976 47 p
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COSATI CODE
A prototype ultraviolet optical instrument designed and developed to monitor 300 level surface cleanliness is described. Size, weight, sensitivity, and simplicity design parameters were satisfied. Tests were conducted with various configurations of the detector array and sample surfaces. Circuit schematics are included. It is shown that output drift is due to effective lamp intensity variations. The instrument is intended to be a part of the integrated environmental contamination monitor of the space shuttle.
Author

ON-GOING RESEARCH PROJECTS

This is a listing of research projects – not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, MINI-RPV (REMOTELY PILOTED VEHICLE) ENGINE DEMONSTRATOR PROGRAM

A.G. BENNETT, Aerotech Co., *Auburn, Alabama* 36830 (DA0D4101; DAAJ02-77-C-0014)

Develop a lightweight multicylinder, two-stroke demonstrator engine to provide the technology base and source for future Army RPV engines for mini-RPV's. Address and solve the current engine problems of high vibration, high weight, high fuel consumption, short life and high cost.

Design, fabricate and test a 20 hp engine and deliver five engines to the government for evaluation. Design utilizes, to the maximum extent possible, high production rate components (cylinders, pistons, etc.). Modify components as necessary to achieve program goals of 1.2 lb/hp, 0.8 lb/hp-hr SFC, 12,000 ft altitude and 150 hour life.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0002, MINI-RPV (REMOTELY PILOTED VEHICLE) ENGINE DEMONSTRATOR PROGRAM

M. JOHNSTON, Teledyne Continental Motors, *Mobile, Alabama* 36601 (DA0D4106; DAAJ02-77-C-0015)

Develop a lightweight, twin cylinder, two-stroke demonstrator engine which provides a technology base for future Army mini-RPV's. Address to and solve existing problems of high weight, vibration levels, fuel consumption and short life.

Design, fabricate, test and deliver for government test five mini-RPV engines designed around currently available high-production engine components, i.e., pistons, cylinders, rods, etc. Make component modifications necessary to achieve the program goals of 1.2 lb/hp, 0.8 lb/hp-hr SFC, 150 hour life, operation to 12,000 ft density altitude.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0003, SUPERHARD TRANSPARENT COATINGS - ARMY HELICOPTERS

G. WINTERMUTE, Goodyear Aerospace Corporation, *Litchfield Park, Arizona* 85340 (DA0D4033; DAAJ02-76-C-0004)

Improve R&M of Army aircraft and reduce current high maintenance and procurement costs due to repetitive replacements of Army helicopter plastic transparencies through the use of abrasion-resistant coatings.

Verify the producibility and applicability of the candidate compositions for a superhard (abrasion-resistant) transparent coating that were developed under contract DAAJ02-73-C-0062, to include full-scale UH-1 windshield application.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0004, ENGINE/AIRFRAME/DRIVE TRAIN DYNAMIC INTERFACE DOCUMENTATION

J.F. NEEDHAM, Summa Corporation, *Culver City, California* 90230 (DA0E3771; DAAJ02-77-C-0035)

The coupled interaction between two or more helicopter dynamic subsystems has often been the source of vibration problems. This is particularly true when considering the helicopter as an dynamic system in which excitations can be generated by any or all of the propulsion system, the airframe or the drive system. The problems of vibration related interface compatibility in engine/drive system installations are usually complicated by the inherent coupling of the three (3) major multi-degree-of-freedom systems, i.e., engine, airframe and drive train. All background data and documentation of past experience lies in the hands of the airframe/engine industry, primarily the former. The technical objective of this contractual effort is to document industry experience to the degree required to permit plans/programs to be formulated as part of an overall government effort to accumulate data which will eventually lead to a solution of generic problems of this type.

Award sole source contracts to the major manufacturers of gas turbine powered US military helicopters, to review existing files, compile reports, memoranda, analytical design efforts, etc., and coordinate with appropriate engine manufacturers.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0005, INVESTIGATION OF HELICOPTER COMPONENT FAILURE PROGNOSIS

J.J. REIS, Northrop Corporation, *Hawthorne, California* 90250 (DA0D3989; DAAJ02-75-C-0019)

The objective of this program is to obtain and analyze data on the relationship of specific sensory outputs to a helicopter gearbox's condition and to investigate their applicability on the determination of the remaining useful life of the component. The efforts to be performed are intended to complement the completed program for investigation of helicopter component failure prognosis under USAAMRDL contract number DAAJ02-72-C-0118.

Conduct mechanical component tests using government-furnished UH-1 series 90 degrees gearboxes in an improved test cell facility capable of providing continuous data collection. Ten gearboxes with incipient bearing failures will be tested over a total test period of 5000 hours. The data shall be processed and analyzed to establish valid predictions of gearbox failure time, time of maximum gearbox deterioration, etc.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0006, DEVELOPMENT OF AN ENVIRONMENTAL DESIGN AND TEST GUIDE FOR ARMY ROTARY WING AIRCRAFT

R.L. MOONAN, Rockwell International Corp., *Los Angeles, California* 90009 (DA0D4006; DAAJ02-75-C-0043)

The objective of this effort is to review and assimilate induced and natural environmental data acquired from industry and government relating to current inventory Army aircraft for the

purpose of developing the methodology to establish the environmental design and test criteria or to actually establish the design and test criteria applicable to future Army aircraft programs and to publish that methodology and/or criteria as a guide for designers and planners.

Following completion of an assessment of natural environment data by MERDC and induced environment data of Army aircraft by Boeing-Vertol, that data will be compiled and combined with other data to be used as a major input for the development of an Army aircraft environmental design guide. The design guide will be developed over five fiscal years- 75, 76, 77, 78, and 79. FY74 effort included the review and preliminary assessment of results of previous and current efforts being accomplished for this directorate by industry/other government agencies, and the establishment of a definitive program plan for future years. Funds will be transferred to various government agencies to defray required consultant service costs.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0007, RESEARCH IN AERODYNAMICS
I.C. STATLER, U.S. Natl. Aero. & Space Adm., Ames Research Center, *Moffett Field, California* 94035 (DA0C5001)

Conduct basic and applied research in joint participation with the NASA-Ames Research Center to provide a technological base in the aerodynamics of rotary-wing and other V/STOL aircraft. The objective is to expand the technologies in those areas which are most likely to impact improved operational and cost effectiveness, survivability and safety of future Army airmobile systems.

Analytical and experimental studies are selected on the basis of a continual review of the Army's aviation objectives and assessment of those fundamental technologies deficiencies which would prevent achievement of the desired objectives. Rotary-wing research will be conducted to develop or improve analytical tools, prediction techniques, and fundamental understanding related to the basic fluid mechanics, acoustics, rotary-wing dynamics and control and flight simulation, and are influenced by the availability of technical personnel and facilities, such as, the 7-by-10 ft low-speed wind tunnel, rotor hover performance acoustic test area, ground-based simulators, computation facilities, and other unique NASA-Ames facilities and support which can be applied to the Army's rotary-wing problems.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Ames Research Center

1.0008, AERONAUTICAL TECHNOLOGY, TECH AREA K - FLIGHT SIMULATION
I.C. STATLER, U.S. Natl. Aero. & Space Adm., Ames Research Center, *Moffett Field, California* 94035 (DA0D5004)

Perform analyses and design studies of the requirements of a rotary-wing R&D flight simulator capable of simulating NOE flight operations. Available simulation technology allows a total integrated systems approach to R&D involving conceptual designs, preliminary and detail design trade-offs, man-machine interactions, mission capabilities, support of flight tests, and product improvement evaluation.

In joint participation with NASA, perform the studies with the expectation of modifying an available NASA simulator to meet the Army's mission requirements.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0009, DESIGN CRITERIA FOR APPLICATION OF MEMBRANE NITROGEN INERTING SYSTEMS TO ARMY AIRCRAFT FUEL TANKS
S.A. MANATT, Signal Companies Incorporated, *Torrance, California* 90509 (DA0D4079; DAAJ02-76-C-0073)

To analytically examine the feasibility of using membrane nitrogen inerting technology to reduce the ullage vulnerability of Army aircraft and to generate preliminary designs for membrane nitrogen inerting systems for the AH-1, CH-47 and OV-1 aircraft.

An analytical estimate of the nitrogen inerting system design requirements and physical parameters will be made for several helicopter systems and missions. Overall relationships between system penalties, configurations, and mission parameters will be obtained. Preliminary designs, including system size, weight, locations, aircraft interface and performance will be accomplished for three Army aircraft. A flightworthy design will be generated for the AH-1G helicopter. A system suitable for laboratory demonstration and experimental evaluation will be designed and fabricated.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0010, ADVANCED DRIVE SHAFT ALIGNMENT INDICATOR PROGRAM - ARMY HELICOPTER
R.B. BOSSLER, Kaman Aerospace Corporation, *Bloomfield, Connecticut* 06002 (DA0D4090; DAAJ02-77-C-0006)

To design, fabricate, field test and evaluate an advanced drive shaft alignment indicator (DSAI), for both static and dynamic modes as a candidate replacement for the present UH-1 and AH-1 drive shaft alignment indicator.

An advanced DSAI, based on a prototype indicator designed under a previous contract, will be fabricated. An optimum procedure using the current UH-1 alignment tools will be developed. The new DSAI along with this optimum procedure will be field tested and evaluated. At the conclusion of the field tests (approx 55 helicopters), the previously developed AVUM procedures will be updated and a final cost and operational effectiveness assessment will be made.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0011, STRUCTURAL CONCEPTS FOR LOW RCS FUSELAGE CONFIGURATION - ARMY HELICOPTERS
D.W. LOWRY, Sikorsky Aircraft Company, *Stratford, Connecticut* 06602 (DA0D4073; DAAJ02-76-C-0062)

Identify the effects of shaping helicooter fuselages for low RCS on the structure in terms of weight, complexity, and costs when compared to a baseline fuselage.

Identify the required data from the baseline Sikorsky UTTAS fuselage. Conduct a structural design analysis for equal baseline strength requirements for the three shaped helicopter fuselage designs supplied by the government. Finalize cost analysis and reporting.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0012, INTEGRATED TAIL ROTOR SERVO POWER MODULE - ARMY HELICOPTER
J. MACIOLEK, Sikorsky Aircraft Company, *Stratford, Connecticut* 06602 (DA0D4062; DAAJ02-76-C-0056)

To design an integrated tail rotor servo power module providing improved survivability with weight savings over existing installation.

Establish the basic design data based on the utility helicopter mission requirement. Design an integrated tail rotor servo power module including complete installation drawings. Conduct a vulnerability analysis of the system considering 7.62mm and 12.7mm API projectiles including average vulnerable area.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0013, ADVANCED TECHNOLOGY COUPLINGS (MODIFIED MISALIGNMENT COUPLINGS) FOR HELICOPTER TRANSMISSION SYSTEMS
R.A. STONE, United Aircraft Corporation, *Stratford, Connecticut* 06602 (DA0D3940; DAAJ02-74-C-0054)

This program will consist of the investigation of new as well as current helicopter coupling concepts with the overall objective of providing the technology necessary to design couplings characterized by improvements in performance (i.e., misalignment, speed, torque) and weight, very high reliability and good maintainability.

The program is a four-task program outlined as follows: Task I -the work to be performed shall consist of an extensive investigation of the capabilities and limitations of current helicopter and industrial couplings, with regard to speed, torque, misalignment, lubrication, reliability and maintainability. Task II - selected coupling candidates will undergo a detail design in conjunction with the formulation of an analytical design technique which will be applicable to any range of speed, torque, misalignment, etc., for the concepts chosen. Tasks III & IV - specific coupling configurations shall be fabricated and tested. All test data will be analyzed to substantiate the analytical design guide, to validate potential performance gains, and identify possible design deficiencies. All design deficiencies will be corrected by redesign with follow-on verification tests.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0014, CRASH DATA RECORDER INVESTIGATION (AIRS)
H. ASK, United Technologies Corp., *Windsor Locks, Connecticut* 06096 (DA0D4068; DAAJ02-76-C-0058)

To design a flightworthy, low-cost accident information retrieval system (AIRS) to provide accurate crash impact conditions and causes. Determine the technical constraints and economics of the design, manufacture and operation of a recorder system for Army helicopters which will: (a) reduce time, cost and inaccuracies of accident investigations, and (b) provide for improved aircraft safety through corrective actions based upon sound crash data.

Utilizing new technology in microdigital preprocessing, data storage, and miniaturized circuits: (a) define flight/crash data to be recorded, (b) design appropriate circuitry, and (c) conduct economic, weight and size analyses with appropriate parameter/cost trade-offs.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0015, ANALYSIS OF HIGH-POWER COMPOSITE ENGINE PERFORMANCE
R.D. BUHLER, Univ. of Stuttgart, Space Propulsion Institute, *Stuttgart, Baden Wuerttemberg, Federal Republic of Germany* D7000 (DA0C9362; DAER075G001)

The proposed aerothermochemical analysis considers composite propulsion systems combining rocket and airbreathing components for special missions with greatly changing flight conditions, high acceleration requirements and/or V/STOL capability.

The performance capabilities of selected system configurations of this group are to be compared for simplified prototype mission-profiles on the basis of the aerothermodynamic performance results combined with estimated system weights.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Research & Standardization Group

1.0016, A STUDY TO INTERPRET THE SURFACE PRESSURE MEASUREMENTS AT THE TIP OF A MODEL HELICOPTER ROTOR IN HOVER
R.B. GRAY, Georgia Inst. of Technology, School of Engineering, *Atlanta, Georgia* 30332 (NAS 1-15158)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0017, STRUCTURE OF SEPARATED FLOW REGIONS OCCURRING NEAR THE LEADING EDGE OF AIR FOILS INCLUDING TRANSITION
T.J. MUELLER, Univ. of Notre Dame, School of Engineering, *Notre Dame, Indiana* 46556 (NSG 1419)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0018, ACTIVE CONTROL SYSTEMS FOR APPLICATIONS TO SUPERSONIC CRUISE AIRCRAFT
E. NISSIM, Israel Inst. of Technology, *Haifa, Israel* (NSG 7373)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0019, AN INVESTIGATION OF ADVANCED HELICOPTER ROTORS HAVING INDIVIDUAL BLADE CONTROL
N.D. HAM, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (NSG 2266)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0020, MAGNETIC CONFINEMENT AND PRECIPITATION OF MACROSCOPIC PARTICLES INJECTED INTO AN AERODYNAMIC BOUNDARY LAYER
J.R. MELCHER, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (NSG 1453)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0021, IR SUPPRESSION DESIGN GUIDE
J.A. SAUNDERS, General Electric Company, *Lynn, Massachusetts* 01910 (DA0D4117; DAAJ02-77-C-0038)

Analyze the infrared suppression technology data developed to date and compile into an infrared suppression system detail design guide that will serve as a government and industry standard.

Assimilate the infrared suppression technology data developed to date and arrange the data into a user manual and design guide criteria for hot parts and plume IR suppression for turboshaft engines. The criteria will aid the suppression system designer in making weight, power requirements, and infrared signature trade-offs for Army aircraft suppression systems.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0022, DYNAMIC RESPONSE OF DOUBLY CURVED STRUCTURES
J. ADACHI, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0D4735)

To examine, measure and describe transient structural response modes of curved structures under blast pressure loads. To develop, improve and verify analytical models and mathematical approaches. Examples of these are the asymmetric small and large deflection response of curved structures to pulse loads, initiation mechanism of buckling in structural shells, structure-pressure wave interaction transition from local response into general structural response and collapse. Layered and composite structures are included. This effort applies to aircraft pacing problem no. 2 - 'Determination of Blast Load Effects on Airframe Structure.'

Combined mathematical and experimental approach utilizes advanced loading, model making, and response measurement techniques to make structural response measurements for comparison to advanced computer code predictions. Full field optical strain and displacement measurements of pulse loaded structures

are being used to evaluate existing buckling prediction methods. The effect of structure-shock wave interaction on the pressure pulse shape is being examined experimentally. Advanced finite-element and finite-difference codes being used include layered composite plate and shell analyses for blast and thermal loads and asymmetric nonlinear buckling analyses for shells under transient loads.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Materials & Mechanics Research Center

1.0023, A STUDY OF LOCAL PARAMETERS AFFECTING EMISSIONS FROM GAS TURBINE ENGINES
C.W. KAUFFMAN, Univ. of Michigan, Graduate School, *Ann Arbor, Michigan* 48104 (NSG 3165)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0024, EFFECTS OF LOW-YIELD NUCLEAR WEAPONS ON AIRFIELDS AND RAILWAY SYSTEMS
L.K. DAVIS, U.S. Army, Waterways Experiment Station, *Vicksburg, Mississippi* 39180 (DA0D8183)

The objective of this study is to provide a reliable means of predicting the effectiveness of ADM's or air-delivered nuclear weapons employed against airfields and railroads. Relative effectiveness will be measured by damage to critical system components, including estimates of time and effort required for hasty and deliberate repair.

The approach will consist of: (a) an experimental program to model weapons explosion effects under realistic conditions at both small and intermediate scales and (b) an analytical effort to extrapolate the empirical results to full-scale weapons and typical airfield/railroad systems.

SUPPORTED BY U.S. Dept. of Defense, Office Chief of Engineers, Waterways Experiment Station

1.0025, STUDY OF GAS-SOLID AIRFLOW OVER A FLAT PLATE
R. OETTING, Univ. of Missouri, School of Engineering, *Rolla, Missouri* 65401 (NSG 1452)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0026, AIRCRAFT CABIN NOISE, PREDICTION AND OPTIMIZATION
R. VAICAITIS, Columbia University, School of Engineering, *New York, New York* 10027 (NSG 1450)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0027, SCATTERING OF ACOUSTIC WAVES BY A BODY IN MOTION
L. TING, New York University, School of Arts & Sciences, *New York, New York* 10012 (NSG 1469)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0028, LARGE AIR TRANSPORT TECHNOLOGY ASSESSMENT
A.J. GELLMAN, Gellman Research Assoc. Inc., *Jenkintown, Pennsylvania* 19046 (ERS76-80328)

This award will provide funds for additional work to be performed in connection with a technology assessment of large cargo aircraft. The original award (NSF-C-1061) supported an exploratory technology assessment of utilization of large aircraft as freight carrying vehicles. This renewal will support additional use of a panel of experts to validate significant findings of the study. The panel represents a wide spectrum of interests likely to be impacted by the utilization of large cargo aircraft. In addition to the air cargo industry, it includes representation from regulatory agencies, financial institutions, consumer groups, environmentalists, regional planning agencies and academic disciplines. The additional work will involve use of research design that will compare responses from experts regarding likely changes in air cargo transportation as a means to validate assessment findings. The basic scope of the original project remains unchanged.

SUPPORTED BY U.S. National Science Foundation, Div. of Exploratory Research & Systems Analysis

1.0029, MINI-REMOTELY PILOTED VEHICLE PROPELLER INVESTIGATION
H.V. BORST, Henry V. Borst & Associates, *Wayne, Pennsylvania* 19087 (DA0D4049; DAAJ02-76-C-0031)

The technical objective is to establish a method for theoretical analysis and performance prediction for mini-RPV propellers. This method shall be verified by correlation with test results for a fixed-pitch prop.

A theoretical method for analyzing small fixed-pitch props shall be devised and applied to a propeller for which test data is available for comparison. This theoretical method shall then be applied to a two-position prop and a variable-pitch prop. The results will be compared to the results of the fixed-pitch prop analysis to compare relative merits.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0030, RESEARCH IN HIGH-TEMPERATURE, ADVANCED COMPOSITE STRUCTURES
C.L. BLACKBURN, Univ. of Tennessee, School of Engineering, *Nashville, Tennessee* 37203 (NSG 1455)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0031, HELICOPTER INTERNAL CARGO LOADING, RESTRAINT, AND UNLOADING INVESTIGATION
H.S. MANKEY, Standard Manufacturing Co. Inc, *Dallas, Texas* 75222 (DA0D4085; DAAJ02-76-C-0074)

To assess the extent to which operations associated with loading, unloading and safe restraint of cargoes internally transported in CH-47 and UTTAS helicopters affect aircraft turnaround time, and to determine the most effective technical approach for establishing improvement.

Current and projected foading, restraint, and unloading tasks for the CH-47 and UTTAS helicopters will be analyzed to determine the effect of each on time and manpower requirements for each operation, and for the overall helicopter turnaround time.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0032, ROTOR BLADE DYNAMIC RESPONSE AND BALLISTIC DAMAGE SURVIVABILITY
H. ZINBERG, Bell Helicopter Company, *Fort Worth, Texas* 76101 (DA0D4018; DAAJ02-75-C-0049)

To develop analytical techniques and modeling methods that will evaluate rotor blade survivability when subjected to ballistic damage in flight. The method shall be capable of evaluating composite and metal constructed main rotor blades for ballistic impacts up to and including 23mm HEI. The boundary conditions for structural stability and the flight regime necessary for 30 minutes safe flight after impact shall be established.

New computer programs will be generated or existing programs modified to account for reduced blade stiffness resulting from ballistic damage. Input data for programs will be blade section properties, location, impact energy and amount of material

removed as a result of damage. Program will calculate blade residual strength blade dynamic properties, and coupled rotor airframe dynamic properties. Static and dynamic tests will be performed on damaged blades and/or blade sections to verify analysis.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0033, HIGH-SPEED ROTOR BALANCING 12515-E
W.D. PILKEY, Univ. of Virginia, School of Engin. & Appl. Sci., *Charlottesville, Virginia* 22903 (DA0B5576; DAAG29 77 G0027)

To develop (1) mathematical programming techniques to optimize the balancing of rotors, and (2) optimize design of suspension systems for rotating shafts. Relevance - the Army is using heavy equipment, large sharfts, and high-speed rotating systems. These require new and sensitive methods of balancing as well as improved methods of suspension. This proposal is addressed to just such needs.

The approach is mathematical using programming techniques as well as statistical methods to investigate noise in the system and its relation to system sensitivity.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

1.0034, EVALUATION OF BEARINGLESS MAIN ROTOR STABILITY USING TRASTAN COMPUTER ANALYSIS
L. SUTTON, Systems Research Labs. Inc., *Newport News, Virginia* 23602 (DA0D4057; DAAJ02-76-C-0032)

To analytically define regions of aeroelastic instability for bearingless main rotor (BMR) and to determine design parameters which can cause such instabilities to occur. This work will be directed toward a careful evaluation of the individual design characteristics of the BMR (i.e., rotor dimensions, stiffness distribution, control system coupling, etc.) performed independent of the primary BMR effort in an attempt to uncover sources of instability before the design is finalized and fabrication has been initiated.

Input data necessary to analyze BMR stability using TRASTAN computer program will be carefully prepared. Where data must be approximated, the significance of the input will be studied to determine if the particular characteristics need further attention during BMR design. The resulting input will be used to perform stability analysis including appropriate variation of important parameters. Results will be evaluated and documented in a letter report to help avoid problems in developing final system hardware.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0035, HT-ST 72-3 ADVANCED STRUCTURAL DESIGN CONCEPTS FOR ARMY AIRCRAFT
I.E. FIGGE, U.S. Army, Air Mobility Res. & Dev. Lab., *Newport News, Virginia* 23604 (DA0C4009)

To develop improved structural design concepts through fabrication and test of structural components utilizing composite materials, to establish payoffs in increased structural efficiency, reduced vulnerability, increased safety and reliability, and reduced fabrication costs of future Army aircraft systems.

Tetra-core panels and shafts will be fabricated and basic structural characterization determined. A tetra-core secondary structure will be designed, fabricated and structurally evaluated. Data will be evaluated and a report written showing the comparative results in terms of structural efficiency, productivity, survivability and risk. Various structural concepts for an AH-1G SYNC elevator will be evaluated to determine the optimum cost and structural design. A detail design will be conducted on the selected concept.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0036, HT AM 75-7- INVESTIGATION OF FLOQUET ANALYSIS FOR APPLICATION TO ROTOR STABILITY PROBLEMS
P.H. MIRICK, U.S. Army, Air Mobility Res. & Dev. Lab., *Newport News, Virginia* 23604 (DA0D3959)

The objective of this program will be: first to review the use of Floquet theory for determining the stability of a system; second, to determine if it is within the capability of this organization to apply Floquet theory in conjunction with an in-house analysis to determine the stability of a rotor system; and third, if it is within the capability of this organization, whether the Floquet theory will be applied.

To gain a thorough understanding of the Floquet theory the basic mathematics of the theory shall be reviewed, a general Floquet computer program written, and the theory then applied to an elementary problem. The use of the Floquet theory in conjunction with an in-house aeroelastic analysis (for example, Y-200) will then be examined. It will be determined if the mathematics and logic of the basic program are well enough defined so that proper input for the Floquet analysis can be obtained and to determine to what extent the basic aeroelastic program will have to be modified to provide proper input to the Floquet analysis. If it is determined that the two techniques are compatible, they will be combined and then applied to a problem.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0037, HT 75-31- AIRCREW PROTECTIVE DEVICES (ARMOR AH-1G)
E.M. PARD, U.S. Army, Air Mobility Res. & Dev. Lab., *Newport News, Virginia* 23604 (DA0D4003)

To pursue the techniques of application of armor systems to Army aircraft to include protection against 14.5mm projectiles and fragments emanating from functioned 23mm HEI projectile threats by designs, fabriction, installation and experimentation to produce positive application of evolving armor material and protective techniques.

The following work will be conducted in-house: preliminary designs, mockup fabrication, installation of mock-ups, fit check, modifications to design mock-ups, attachment bracketry, final design drawings and installation handbook for two (2) armor systems that will provide protection to the aircrew of the AH-1G (Cobra) helicopter against 14.5mm and 23mm HEI threat levels, operational tests/evaluation of armor systems shall be conducted at Ft. Rucker. The following work shall be conducted under conducted under contract: armor system - one (1) EA shall be procured under contract for the AH-1G (Cobra) helicopter. The systems shall be fabricated in accordance with government-furnished drawings and specifications.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0038, EFFECTS OF ANGLE-OF-ATTACK ON THE COUPLED RADIATIVE AND CONVECTIVE HEAT TRANSFER ABOUT BLUNT PLANETARY ENTRY BODIES
S.N. TIWARI, Old Dominion University, School of Engineering, *Norfolk, Virginia* 23508 (NSG 1464)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0039, STUDY OF A MINIMUM-INTERFERENCE WIND TUNNEL FOR HIGH-LIFT WINGS IN THREE DIMENSIONS
R.G. JOPPA, Univ. of Washington, School of Engineering, *Seattle, Washington* 98105 (NSG 2260)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, PHOTOELECTRONIC PROPERTIES OF II-VI HETEROJUNCTIONS
R.H. BUBE, Stanford University, School of Engineering, *Palo Alto, California* 94305 (EY-76-S-03-0326-047)

It is the purpose of this program to prepare II-VI heterojunctions in film-on-crystal and film-on-film form in order to investigate the energy parameters and transport processes that control the electrical, photoelectronic and photovoltaic properties of these junctions. Particular attention will be paid to heterojunctions in the n-ZnCdS/p-CdTe and n-In2O3.SnO2/p-CdTe systems that are of interest for their photovoltaic properties. It is also the purpose to carry out a detailed and careful comparison of the properties of thin-film and single-crystal Cu2S/CdS heterojunctions, prepared under identical conditions and analyzed in identical ways, in order to obtain a more complete understanding of the controlling mechanisms in this cell, to improve the solar efficiency, and to stabilize the cell under operation.

Specific goals include: (1) preparation and control of II-VI films with known and reproducible properties, prepared by vacuum evaporation, spray pyrolysis or related techniques; (2) evaluation of heterojunction properties through measurements of J-V curves in dark and light, junction capacitance, spectral response, diffusion lengths, etc.; (3) evaluation of junction structure and composition; and (4) provide feedback between preparation and properties.

RESULTS: Heterojunctions with solar efficiencies in the range of 6 to 8% have been prepared by vacuum evaporation of spray pyrolysis deposition of thin-film CdS on single-crystal CdTe. High-conductivity ZnSe films have been deposited by vacuum evaporation. Ohmic contacts have been made to p-CdTe using a p ion -Cu2S layer; n-ITO/p-CdTe junctions exhibit photovoltaic properties meriting further investigation. The effect of heat treatment on the optical and electrical properties of n-ITO films has been investigated. ZnCdS films and n-ZnCdS/p-CdTe heterojunctions have been prepared using spray pyrolysis.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Basic Energy Sciences

3.0002, TERNARY COMPLEXES OF NUCLEOTIDES, AMINO ACIDS AND METAL CATIONS BY POTENTIOMETRIC TITRATION (ABBREV)
J.B. ORENBERG, Calif. State Univ. & Colleges, School of Natural Sciences, *San Francisco, California* 94132 (NCA 2-660802)

Determination of the stability of constants and self-organizing properties of ternary complexes involving nucleotides, amino acids and metal cations by potentiometric titration.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0003, STUDY OF CHEMICAL EVOLUTION INTERACTIONS OF METAL IONS AND NUCLEOTIDES
A.L. FURST, Univ. of San Francisco, School of Science, *San Francisco, California* 94117 (NSG 2276)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0004, CHARACTERIZATION AND DEGRADATION STUDIES ON AROMATIC POLYIMIDES AND POLYESTERS
A.C. LING, Calif. State Univ. & Colleges, School of Science, *San Jose, California* 95114 (NSG 2274)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0005, SYNTHESIS OF FLUOROCARBON ETHER MONOMERS AND ELASTOMERS
A.C. LING, Calif. State Univ. & Colleges, School of Science, *San Jose, California* 95114 (NSG 2273)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0006, STRUCTURAL MATERIALS COMPATIBILITY
A.F. CLARK, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Boulder, Colorado* 80302 (2750539 (NBS NO.))

PURPOSE: To understand the low-temperature behavior of structural materials to insure their compatibility with cryogenic environments and develop and document their properties to maximize their utilization in cryogenic applications.

OBJECTIVES: Determine the compatibility of structural materials in oxygen environments; investigate low-cost alloy for safe use with LNG; apply fracture mechanics to establish fitness for low-temperature service; determine stress and fatigue effects on superconducting coil composites and components; transfer low-temperature materials behavior information into current practice.

FY77 MILESTONES: 1. Characterize mechanical, thermal, and electrical properties of superconducting magnet composite and Cu stabilized, Nb, Ti wire, July 1977. 2. Analyze fracture behavior of weld heat affected zone of sulfide shape-controlled ship hull steels, July 1977. 3. Investigate superconducting properties of dispersed Nb in bronze matrix, July 1977.

ACCOMPLISHMENTS: 1. Obtained mechanical properties characterization of 5% Ni steel welds. 2. Characterized the effects of thermal-mechanical-magnetic interactions of a superconducting coil composite on magnet performance by analytical calculations. 3. Examined copper purity after various melting and oxidation treatments in magnetic field gradients. 4. Identified and cataloged observed emission lines during combustion of titanium and titanium alloys in oxygen.

ADDENDA: This project is also supported by: NASA, ERDA, DOC.

SUPPORTED BY U.S. Dept. of Defense, Unspecified Unit

3.0007, RELATIONSHIP BETWEEN MICROSTRUCTURE AND MECHANICAL PROPERTIES OF INTERMETALLICS
J.J. HREN, State University of Fla. Sys., School of Engineering, *Gainesville, Florida* 32611 (DF047770; AF-AFOSR-3254-77)

AF function - requirements for gas turbine engines include strong, lightweight, oxidation-resistant materials for high-temperature operation. A need exists for materials to operate at higher engine temperatures (to improve operating efficiency), and for lighter weight materials (to decrease engine weight, engine operating stresses due to heavy components, and fuel consumption). The needed materials must have the same density as titanium combined with the mechanical properties and oxidation resistance of nickel base superalloy. Opportunity -intermetallic compounds in general, and the titanium aluminides in particular, have exhibited great potential for such applications. Unfortunately, nearly all intermetallic compounds are brittle at low temperatures, making their fabrication difficult and presenting potential hazards in service. However, recent reports indicate that some alloying additions can substantially improve low-temperature ductility. Objective - this research will determine the intrinsic mechanisms of deformation and the available means for their control in a wide class of intermetallic compounds. How work contributes - initially, the investigation will be directed towards clarifying the source of improved ductility in the titanium aluminides.

The research will involve fabrication, testing, and detailed microstructural analysis of a range of alloys. Prime goals will be to deduce the microstructural sources of these beneficial effects and to discover guidelines for more general application. The strength of these studies is founded on the use of advanced electron metallographic techniques.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

3.0008, SULFUR IN THE CORROSION OF SUPERALLOYS 11842-MS
J.B. COHEN, Northwestern University, Technological Institute, *Evanston, Illinois* 60201 (DA0D9273; DAAG29 76 G0196)

To study the rate and the mechanism of diffusion of sulfur in mono-and polycrystalline oxides of transition metals, with and without minor additions that will modify the abundance of crystalline defects (e.g., Cr sub 2 0 sub 3 or Li sub 2 0 added to NiO). Relevance - the corrosion of gas turbines, e.g., in aircraft, is intensified by the presence of sulfur in the fuel. Army technologists have voiced the need of a fundamental study of reactions of refractory metals and alloys with gases at the temperature of gas-turbine blades. Knowing how sulfur passes through the protective oxide on the blades is a vital part of understanding the whole destructive interaction.

Experiments will include: 1) measurement of the diffusion of (35)S in doped and undoped single crystals of nickel oxide, and Cr sub 2 0 sub 3, and in hematite (Fe sub 2 0 sub 3), 2) measurement of the diffusion of (63)Ni in mono-crystalline nickel oxide doped with sulfur, 3) determination of the soulubility of sulfur in nickel oxide, 4) study of sulfur-doped nickel oxide by electron spectroscopy (ESCA), 5) study of the sulfidation of metals and alloys by SO sub 2/0 sub 2 mixtures.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

3.0009, ENHANCEMENT OF APPEARANCE POTENTIAL SPECTROSCOPY DATA BY NOISE REMOVAL AND DECONVOLUTION
G.E. IOUP, Louisiana State Univ. Systems, School of Arts & Sciences, *New Orleans, Louisiana* 70122 (NSG 1460)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0010, HOT PRESSING OF SILICON NITRIDE FOR PROPULSION AND POWER GENERATION SYSTEMS
G.E. GAZZA, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0E4741)

Advanced ceramic processing and fabrication methods are required to produce silicon nitride materials for critical Army applications such as nozzles, guide vanes, rotors, bearings, etc. Development of material properties are required for operating temperatures approaching 2500 degrees F needed for high engine efficiency. Fabrication of shaped components is desired for minimizing machining costs. The pacing materials problem area is high-temperature materials under the surface mobility mission area. Thrust - cost reduction via fuel economy.

To synthesize silicon nitride ceramics using various sintering additive and consolidate by hot pressing. The effect of various additives will be studied by mechanical, chemical, physical and structural characterization. Fabrication of simple and complex shapes will be accomplished. Pertinent properties will be determined up to temperatures approaching 2700 degrees F.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Materials & Mechanics Research Center

3.0011, MASS-SPECTROMETRIC STUDIES OF HIGH-TEMPERATURE MATERIALS
A. KANT, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0D4818)

The objectives are (1) To measure the high-temperature thermodynamic properties (energetics of formation of solid solutions and compounds, phase equilibrium) of low-density, high-strength materials which have potential use as structural materials (aircraft) and projectile-resistant materials (armor). The systems to be investigated include carbides, nitrides, silicides, and borides with the present specific emphasis on the aluminum-boron system. (2) To determine the kinetics and establish the mechanism of vaporization processes involving these materials. The work is relevant in all areas where a knowledge of the stability (both thermodynamic and kinetic) of high-strength, low-density materials is required for design and fabrication purposes. Specific examples of applicability are: high-temperature-resistant materials for rotor blades and vanes, and materials exposed to rocket exhaust and turbine inlet high temperatures.

Molecular beams formed from the evaporated molecules are studied by mass spectrometric techniques to elicit information about the nature and properties of the molecules in the beam and of the condensed phases in equilibrium with the vapor. Kinetics of vaporization are studied by measuring the rates of formation of various vapor species under conditions in which the vaporization process is the rate-determining step in production of the molecular beam.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Materials & Mechanics Research Center

3.0012, VISCOELASTIC CHARACTERIZATION OF FILAMENTARY COMPOSITES
E.M. LENOE, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0D4750)

To provide the necessary data to effectively assess filamentary composites over the appropriate temperature range for use in aircraft and missile structures. Specific objectives include determining the anisotropic viscoelastic functions and characterizing the mechanical response of composite materials of importance in Army materiel.

Viscoelastic characterization of boron aluminum and a selected graphite epoxy will be completed. Preliminary evaluation of time-dependent behavior of Kevlar and of the 3m glass epoxy used in AMMRC environmental deterioration studies will be undertaken. Laminate theories appropriate for the composite materials which have been studied during this project will be suggested. Future efforts, under another work unit, will be devoted to the failure behavior of hybrid composites under combined stress and complex loading paths. The linear viscoelastic characterization studies will be terminated.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Materials & Mechanics Research Center

3.0013, DEVELOPMENT OF SURFACE TREATMENT FOR UNIFORM CASE DEPTH HARDENING OF X-2 ALLOY GEAR STEELS
M. LEVY, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0E4801)

To develop a carburizing procedure for X-2 alloy tool steel for use as a gear material for helicopter transmissions.

Alloy steel Vasco X-2 and another candidate advanced gear material of vacuum melt grade will be heat treated and case hardened by conventional gas carburizing as well as by vacuum carburizing utilizing chemical and electrochemical pretreatments to nullify the adverse effect of chromic oxide scale. Aisi 9310 gear steel will be utilized to establish baseline data. Evaluation will be made of uniformity of case depth and effectiveness of pretreatments using metallography, hardness surveys, scanning electron microscopy, X-ray diffraction, electron microprobe analysis, and other techniques.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Materials & Mechanics Research Center

3.0014, PROCESSING MECHANISMS, STRUCTURE, AND MORPHOLOGY OF HIGH-TEMPERATURE POLYMERIC ALLOYS
I.L. HAY, Celanese Corporation of Amer., *Summit, New Jersey* 07901 (DF047260; F49620-77-C-0046)

AF function - advanced Air Force lightweight aircraft, missile and satellite systems will utilize structural matrices and adhesives which will provide high performance at elevated temperatures in extreme service environments. Deficiency - the most stable polymer systems are relatively intractable and difficult to process by current fabrication techniques. Objective - the princi-

ples and mechanisms underlying the alloying of intractable, high-temperature polymers will be investigated. How work contributes - it is expected that this research will yield combinations of polymers that are more readily fabricable and have high-temperature properties similar to the major intractable components.

Research will center on (1) the processibility of intractable polymers when alloyed with compatible polymers and monomers, (2) correlation of the particulate form and character of polymer mixtures before hot pressing with physical and mechanical properties after consolidation, (3) the assessment and utilization of various experimental techniques to characterize the chemical and physical interactions occurring during processing and to establish the chemical nature of the polymer alloys.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NC, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

3.0015, PHYSICS AND CHEMISTRY OF MATERIALS
J.A. BRUCE, U.S. Air Force, Rome Air Development Ctr., *Rome, New York* 13440 (DF902900)

AF function - development and improvement of electromagnetic materials and components used in C3 applications. Deficiency - need to characterize the structure and properties of EM materials and components to aid their development and improvement. Objective - to study the chemistry and physics of bulk and thin film materials, surfaces and device structures. How research contributes - this work is in direct support of both materials and device programs of this laboratory.

Defect properties such as dislocations of stacking faults, microtwins, impurities, etc., of components, device structures and their associated materials will be examined by X-ray topography and transmission electron microscopy. Scanning electron microscopy, optical microscopy and Auger spectroscopy techniques will be combined for both chemical and topological analysis of surfaces. Structured and chemical composition will be determined by both X-ray and electron diffraction.

ADDENDA: Supporting agency address is: Rome Air Development Center ETS, Griffiss AFB, N Y 13440

SUPPORTED BY U.S. Dept. of Defense, Air Force

3.0016, MAGNETIZATION MEASUREMENTS ON BISMUTH MANGANESE SUBJECTED TO STATIC AND DYNAMIC STRESSES AS A FUNCTION OF TEMPERATURE
K. SCHRODER, Syracuse University, School of Engineering, *Syracuse, New York* 13210 (NSG 1462)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0017, NMR AND IR STUDY OF MOISTURE IN EPOXY RESINS AND RESIN-GRAPHITE FIBER COMPOSITES
J.D. MEMORY, Univ. of North Carolina, School of Math. & Phys. Scis., *Raleigh, North Carolina* 27607 (NSG 1463)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0018, PROPULSION TECHNOLOGY
E.E. BAILEY, U.S. Army, Air Mobility Res. & Dev. Lab., *Cleveland, Ohio* 44135 (DA0E3534)

Implement research and development program for advanced propulsion and drive train components relevant to current and potential future Army aircraft application. Provide the technology base for evaluation of concepts for improvement and application including considerations for related needs in fabricational techniques.

In joint participation with NASA-Lewis Research Center, conduct analyses, element design, fabrication, tests, and breadboard hardware evaluation of advanced propulsion and drive train concepts. Work is jointly conducted with NASA with emphasis on turboshaft engine technology including compressor, turbine, combustor and the resulting requirements on seals, shafting, bearings, gears, and material.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

3.0019, DEFORMATION STRUCTURES IN METAL CRYSTALS DUE TO WEAR AND MACHINING AT HIGH SPEED
J.T. BLACK, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (NSG 3164)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0020, PROTECTION OF CAST MAGNESIUM
A. GALLACCIO, U.S. Army, Pitman Dunn Research Labs., *Philadelphia, Pennsylvania* 19137 (DA0B0620)

The purpose of this task is to determine optimum surface treating and coating systems for protection of cast magnesium alloys AZ91C-T6, EZ33A-T5, and ZE41A-T5, and concurrently to ascertain minimal compromise of fatigue endurance of the castings coated with different protective systems. Optimum protective systems are required for use on cast magnesium housings and parts employed in Army helicopters, and for housings and mounting plates for weaponry and electronic equipment. This task is in support of major thrusts in aircraft, air-defense, weapons, warhead and guidance systems.

Failures of protective systems applied to cast magnesium power transmission housings (helicopters, AVSCOM), to arming equipment mounting plates (warheads, MUCOM-PA) and to housings for electronic sensing and guidance packs (HDL) have led to premature corrosion and increased maintenance. Where electrical continuity of the magnesium surfaces is not required, protective systems which are specified frequently employ chromate pretreatment in addition to a resin finish coating system. For a more effective protection system, anodic surface treatment is recommended where the fatigue strength of the castings will not be compromised. Where electrical continuity is required, electrodeposited metal barrier coatings are comprised of a copper preplate and a nickel barrier overplate which are used. This system is breeched even in relatively mild environments because of the very unfavorable anode-cathode relationship of metallic coating systems normally specified (Cu-Ni, Cu-Sn, or Sn-Zn); these have marked potential protection deficiency. The development of metallic coatings systems which are more compatible with and protective of magnesium under atmospheric conditions containing chlorides and covering the full range of humidity (with periodic condensation) is being pursued. Plated and metal-rich coatings will be considered.

SUPPORTED BY U.S. Dept. of Defense, Army, Armament Command

3.0021, EVALUATION OF FAILURE MECHANICS IN COMPOSITES
J.L. SWEDLOW, Carnegie Mellon University, Inst. of Technology, *Pittsburgh, Pennsylvania* 15213 (NSG 3172)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0022, CONTROL OF INTERFACE REACTIONS IN COMPOSITES
C.R. HOUSKA, Virginia Poly. Inst. & St. U., School of Engineering, *Blacksburg, Virginia* 24061 (NSG 1470)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0023, RESEARCH IN STRUCTURES
J.L. SHIPLEY, U.S. Natl. Aero. & Space Adm., Langley Research Center, *Hampton, Virginia* 23665 (DA0E3550)

To conduct basic research to provide the fundamental structures and materials application technology necessary for a viable structures program. Efforts include the development of analytical techniques for advanced structures, development of the fatigue and fracture characteristics of the structures, development of an understanding and prediction of fracture mechanisms in composite materials and the demonstration of advanced materials on Army helicopters.

Development of structural analysis techniques will emphasize interdisciplinary design programs and continuation of application of Nastran to helicopters. Fatigue and fracture mechanics will involve analytical and experimental investigations of debond failure mechanisms in composite laminates and determination of environmental effects on the fatigue life of composite materials. Application of composites to helicopters will include the development of structural criteria for the bearingless rotor and the evaluation of service experience with the boron reinforced CH-54 tail cone. The prestressed rotor SPAR concept will be evaluated for its capability to retard fatigue crack growth and a structural dynamics model of the AH-1G will be developed.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, CALCULATION OF SEPARATED FLOW ABOUT A GENERAL BODY IN A NON-UNIFORM ONSET FLOW, 13690-EX

J.L. HESS, McDonnell Douglas Corporation, *Long Beach, California* 90808 (DA0E9040; DAAG29 76 C 0021)

To analyze the flow about a general three-dimensional body immersed in a non-uniform onset flow with the aim of predicting the aerodynamic pressures and forces acting on the body. The proposed investigation is directly relevant to the problems of missile separation on helicopters being studied at both MICOM and AMRDL-Eustis Directorate and is also relevant to the problem of gusts and round-to-round and launcher-to-round interferences on missiles.

Existing general surface singularity methods for calculating potential flow with uniform onset flow will be generalized to account for non-uniform onset flow conditions and possibilities of separated flow regions. Separated flow regions will be treated by either wake shape being input to calculation or having wake shape determined as part of an iterative computation.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

4.0002, ATMOSPHERIC FLUID DYNAMICS

F.H. BUSSE, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (ATM76-22280)

The proposed research involves basic mechanisms of atmospheric fluid dynamics with emphasis on nonlinear processes. Both experimental and theoretical projects are planned. The major experimental project is a study of convection in mercury based on a new visualization technique. The goal of this research is to gain an understanding of the transition to turbulence in low Prandtl number convection comparable to the one achieved in high Prandtl number convection. In addition, it is proposed to continue the experimental investigation of differential rotation generated by convection columns in rotating systems and to extend the study of spoke pattern convection to higher Rayleigh numbers.

The theoretical part is concerned with the instabilities of Taylor vortices and Ekman rolls. It is expected that in conjunction with the earlier work on convection rolls in the presence of a mean shear a general picture of the instability mechanisms of longitudinal rolls will evolve which can be applied to interprete observed three-dimensional features of atmospheric rolls. In addition, an investigation of finite amplitude properties of three-dimensional convection in a rotating system is planned to resolve the paradoxical situation which exists in this field at the present time. A third theoretical project is concerned with the properties of oscillatory convection rolls.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

4.0003, EIGHTH U.S. NATIONAL CONGRESS OF APPLIED MECHANICS

J.D. COLE, Univ. of California, School of Engin. & Appl. Sci., *Los Angeles, California* 90024 (NSG 2270)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0004, THE INVESTIGATION OF AN AUGER ELECTRON MICROPROBE - ITS CAPABILITIES, LIMITATIONS, AND APPLICATIONS

W.E. SPICER, Stanford University, School of Engineering, *Palo Alto, California* 94305 (NCA 2-745803)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0005, MICROWAVE RAIN SENSING

D. HOGG, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8AA72943)

PROJECT OBJECTIVE: Design, construction and operation of remote-sensing microwave systems that continuously and reliably monitor rain rate over an area of the earth.

CURRENT YEAR PLAN: To construct and demonstrate a cartwheel microwave transmission system for covering an area of about 70 km2 in the Boulder area, for flood warning, and for calibration of local weather radar; to pursue research on microwave radiometric rain monitoring.

PROGRESS REPORT: Design of the cartwheel system and critical components is in progress.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

4.0006, ENGINEERING MEASUREMENTS

J.S. HILTEN, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234 (4253131)

PURPOSE: Advancement of transducer-based measuring and control capabilities required by Government and industry, by solving selected problems in the practical measurement environment and dissemination to industry and standards organizations of results of associated OA activities.

OBJECTIVES: Survey transducer technology to identify problem areas, plan NBS/OA transducer program to meet identified needs, support transducer-related standardization efforts, support short term feasibility studies of transducer-based engineering measurements as seed efforts, provide effective dissemination of knowledge obtained in NBS and OA work.

FY77 MILESTONES: Disseminate results of OA work on dynamic calibration method for pogo pressure trnasducers; 3/77. Participate in 9th Transducer Workshop, Transducer Committee, TG/RCC, 5/77. Survey transducer problems inhibiting energy conservation effectiveness, 9/77. Participate in standardization activities of ISA, ANSI, SAE, 9/77.

ACCOMPLISHMENTS: NBS TN 905 - Evaluation method for transducer performance in severe environments. NBS TN 914 - Extension of dynamic pressure calibration capabilities into regions previously not attainable. NASA-CR-13505, NBSIR 76-1026 - Assessment of thermocouple durability in jet-engine environment.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

4.0007, PRE-COOPERATIVE ENGINEERING EDUCATION PROGRAM
D. INGERSOLL, Northwestern University, Graduate School, *Evanston, Illinois* 60201 (NGT 14-007-780)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0008, ADVANCED INDUSTRIAL ROBOT CONTROL SYSTEMS
R.P. PAUL, Purdue University, School of Engineering, *Lafayette, Indiana* 47907 (APR77-14533)

Major limitations to the use of today's industrial robots in batch manufacturing are their limited adaptability, speed of operation and cost. This research, in the area of advanced industrial robot control systems, is directed at improving current industrial robot performance and providing a solid knowledge base for future robot systems. Specific research objectives are: To provide coordinated motion control schemes which are simple but will allow operation of industrial robots on moving assembly lines. To increase the speed of current industrial robots in moving along a path and provide for complaint motion of the robot end effector ('hand') by sensing the torques felt at the robot arm joints. To transfer the robot control software to a distributed microprocessor system and examine trade-offs between software and hardware servomechanism control. To expand an existing robot computer vision system used to identify two-dimensional visual scenes to detect three-dimensional scenes of objects on a moving conveyor. This will involve the automation of three-dimensional visual information for robot arm control via a two-dimensional projection using a solid-state array camera.

SUPPORTED BY U.S. National Science Foundation, Div. of Advanced Productivity Research & Technology

4.0009, LASER VELOCIMETER MEASUREMENTS & ANALYSIS IN TURBULENT & MIXING FLOWS
H.D. THOMPSON, Purdue University, Purdue Research Foundation, *Lafayette, Indiana* 47907 (DF461070; F33615-77-C-2010)

To experimentally and analytically investigate the biasing of individual realization LDV signal and to investigate the feasibility of the use of fluorescent dye tracers in the study of mixing and turbulence.

The effort shall include the further development of existing turbulence and mixing models, the identification of the LDV signal biasing associated with the models and the development of carefully controlled experiments to measure the biases in actual flows. A suitable experiment shall be defined and carried out to determine the feasibility of the use of fluorescent dye tracers in the study of mixing and turbulence.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory RJT, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0010, LIGHT SCATTERING IN MAGNETIC SEMICONDUCTORS
M.S. DRESSELHAUS, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (DMR73-02473 A02)

Same as original, Grant DMR73-02473 AO1. This is a supplemental grant to allow the Principal Investigator to complete this research on Raman scattering in magnetic semiconductors utilizing a newly acquired krypton laser and a newly developed right-angle scattering geometry.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

4.0011, DEVELOPMENT OF PARTIAL CHANNEL FLOW FOR ARBITRARY INPUT VELOCITY DISTRIBUTIONS USING BOUNDARY-FITTED COORDINATE SYSTEMS 13675-EX
L.R. HESTER, Mississippi St. University, School of Engineering, *Mississippi State, Mississippi* 39762 (DA0E9022; DAAG29 76 G0144)

To develop numerical solutions for time-dependent, two-dimensional incompressible laminar partial channel flow. This investigation is directly relevant to research on fluidic devices, utilized for example in such Army applications as helicopter and tank stabilization systems, being conducted at HDL, and impacts on the techniques for modeling of flows in rivers, estuaries, and coastal seas being carried out at Waterways Experiment Station.

A numerically generated curvilinear coordinate system having a coordinate line coincident with the boundary contour will be utilized for solving the Navier-Stokes equations of viscous fluid mechanics describing flows through arbitrarily shaped channels.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

4.0012, SEMIDIRECT METHODS FOR DISCRETIZED NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS, WITH PARTICULAR APPLICATIONS TO FLUID DYNAMICS 13599-MX
P.J. ROACHE, Ecodynamics Res. Assoc. Inc., *Albuquerque, New Mexico* 87108 (DA0E9034; DAAG29 76 C 0018)

To develop efficient methods for solving the nonlinear partial differential equations of fluid mechanics. Fluid mechanics problems arise in many Army settings. Improved methods will be of importance in attacking more complicated flows. A sample of cited relevant Army problems includes heat transfer, gas gas flow, airfoil flow and transonic flow.

Emphasis will be placed on the improvement of the numerifcal properties of the methods and the incorporation of physical features (turbulence, temperature-dependent viscosities, complex geometries, etc.) into the class of equations for which the methods are valid.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

4.0013, ASSESSMENT OF DATA BASE SEARCHING AND DOCUMENT DELIVERY VIA COMMUNICATIONS SATELLITE
R.G. LERNER, Amer. Inst. of Physics Inc., *New York, New York* 10017 (DSI77-18052)

The project is an experiment designed to evaluate remote search of STI abstracts and other bibliographic information combined with the delivery of full text of documents using a communication satellite and facsimile transmitters. The American Institute of Physics provides the physics and astronomy literature through the AIP SPIN data base from 1975 on, resident in the Lockheed DIALOG data base. Participating NASA scientists and engineers will access the data base via a satellite link from NASA Ames, Goddard, and Lewis. The Jet Propulsion Laboratory will be serviced by telephone line to Lockheed. Lockheed will transmit requests for materials identified as being of immediate interest to AIP in New York via telephone. In New York, AIP will initially transmit the required article in real time using a standard facsimile device to the requesting site. In the final quarter of the experiment, the facsimiles will be transmitted via a satellite line; additionally, AIP may provide the approved manuscript copy for video scanning or slow-scan TV transmission, with or without a facsimile copy.

SUPPORTED BY U.S. National Science Foundation, Div. of Science Information

4.0014, DEVELOPMENT OF A METHOD FOR COMPUTING SUBSONIC AND TRANSONIC SEPARATED FLOWS 12437-E
P.M. GERHART, Univ. of Akron, School of Engineering, *Akron, Ohio* 44304 (DA0E8973; DAAG29 77 G0030)

To develop an analytical method for computation of subsonic and transonic separated flows which is both practical and reasonably accurate for determining force changes on the body due to separation effects. This project is directly relevant to the transonic experimental and analytical work being done at MICOM, to the work on separated flows in exterior ballistics at BRL, and to the helicopter research program at AMRDL-Ames Directorate.

Based on the concept of dividing the flow field into viscous and inviscid regions, several essential elements for a successful computation procedure for separating, separated, and reattaching subsonic trubulent flows will be tried utilizing the momentum and kinetic energy integral equations for the viscous flow and small-disturbance theory for the inviscid flow.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

4.0015, PRE-COOPERATIVE ENGINEERING EDUCATION PROGRAM
V. VELEZ, Univ. of Akron, Graduate School, *Akron, Ohio* 44304 (NGT 36-001-780)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0016, PRECOOPERATIVE ENGINEERING EDUCATION PROGRAM
W.R. BENNETT, Cleveland State University, Graduate School, *Cleveland, Ohio* 44115 (NGT 36-025-780)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0017, APPLICATION OF COARSE MESH REBALANCING METHODS TO AERODYNAMIC EQUATIONS
S. NAKAMURA, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (NCA 2-565801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0018, INVESTIGATION FOR IMPROVED PRECISION IN AERIAL APPLICATION EQUIPMENT
L.O. ROTH, Okla. St. Univ., School of Agriculture, *Stillwater, Oklahoma* 74075 (NSG 6018)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0019, STABILITY CRITERIA GOVERNING VENT/FILL LINES OF CRYOGENIC STORAGE VESSELS
J.A. LIBURDY, State University & Comm. Coll., Graduate School, *Memphis, Tennessee* 38111 (NSG 2272)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0020, INVESTIGATION OF THE FEASIBILITY OF THE ELECTRON BEAM-EXCITED HIGH-PRESSURE CHARGE TRANSFER LASER
C.B. COLLINS, Univ. of Texas, Graduate School, *Richardson, Texas* 75080 (ENG74-06262 A01)

The objective of this research is the continuation of studies to verify the feasibility of developing an electron beam excited helium plasma into a collisionally pumped laser emitting in the visible or near-UV with 5-29% efficiency. The developing kinetic model has reached a level of sophistication sufficient to predict thermal scaling, recently observed in this work. Continuation of the two ongoing lines of research currently pursued involves measurements of the rate coefficients of the elementary reactions of importance to potential laser pumping sequences, and the demonstration that useful laser outputs can be pumped. This is a continuation of research previously supported under NSF grant ENG-7406262.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0021, ANALYSIS AND IDENTIFICATION OF FLIGHT MEASUREMENTS BY TIME-DOMAIN/RANDOMDEC TECHNIQUE
S.R. IBRAHIM, Old Dominion University, Graduate School, *Norfolk, Virginia* 23508 (NSG 1459)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0022, DEVELOPMENT OF CONTROLLER DESIGN METHODOLOGY FOR LARGE FLEXIBLE SPACE STRUCTURES
A.S. ROBERTS, Old Dominion University, School of Engineering, *Norfolk, Virginia* 23508 (NSG 1473)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, IONOSPHERIC AND PLASMASPHERIC TOTAL ELECTRON CONTENT STUDIES IN THE SOUTHERN HEMISPHERE
UNKNOWN, Mackenzie University, *Sao Paulo, Brazil* 01000 (DA0D9315; DAERO 77 G0029)

To undertake studies of the ionosphere so as to be able to predict its temporal and spatial properties so as to allow a single channel radio satellite navigation system to be developed.

Development of total electron content of the ionosphere and plasmasphere measurements using Faraday rotation and group delay techniques. These measurements are based on ATS-6 transmissions, and are performed at different locations in Brazil, depending on satellite's 'visibility', and interests on specific geographic locations (for example, the geomagnetic anomaly, the geomagnetic equator).

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Research & Standardization Group

5.0002, UNDERWAY MONITORING IN MARINE AND ESTUARINE ENVIRONMENTS
P. WILDE, Univ. of California, Lawrence Berkeley Laboratory, *Berkeley, California* 94720

The increased development of offshore oil production off the Atlantic, Pacific, and Alaskan coasts of the United States means that an increasing volume of tanker and pipeline traffic will be added to American ports. The delivery of petroleum from the offshore wells to coastal sites also suggests that most of the petroleum will be processed in or near the coastal zone, and in many cases will be transhipped back across the coastal zone as refined products. The combination of the increase in both petroleum traffic and refinery production adds to potential environmental disruption of the coastal zone in the vicinity of port areas. To prevent any deleterious consequences of the transport of petroleum and petroleum products across the coastal zone, a rational program of environmental monitoring should be initiated in affected port areas. A system approach to the study of marine environments appears to be necessary. The feasibility of such a system has been demonstrated by enclosing sensors, a recording system, and power supply in a vehicle of limited size that could be

towed from a small boat in a variety of vertical modes or could be operated by a diver. Included in the monitoring package were sensors that could measure significant electrochemical and electrophysical parameters in coastal and estuarine environments.

RESULTS: Prototype instrumentation has been developed. The basic configuration is that of an airplane with fixed wings and rear movable elevators. A choice of speeds (1-4 knots), operating depths (1-30 meters,) and operating modes is available. Parameters recorded include oxidation-reduction potential, pH, DO, sulfide concentration, temperature, conductivity, ambient light level, and depth.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Biomedical & Environmental Research

5.0003, PHYSICO-CHEMICAL PROCESSES AT THE GLACIER-ROCK INTERFACE

B. HALLET, Stanford University, School of Earth Sciences, *Palo Alto, California* 94305 (EAR77-13631)

This project involves a study of glacier sliding and other near-bed processes. The primary focus will be on subglacial chemical processes. Included will be a detailed study of the morphology, structure, distribution, and geochemistry of mineral deposits formed by chemical precipitation from subglacial waters and zone-melting experiments designed to investigate the freezing and solution processes that appear to concentrate solutes in subglacial waters. A second phase of the study will involve a study of velocity profiles from aerial photographs and other sources in order to investigate the relative importance of internal deformation and basal sliding in surging glaciers. The research is expected to add to the knowledge on basal sliding in temperate glaciers of both the surging and non-surging types and on subglacial chemical processes.

SUPPORTED BY U.S. National Science Foundation, Div. of Earth Sciences

5.0004, STUDIES IN PLANETARY IMPACT CRATERING AND GEOMORPHOLOGY

H.R. AGGARWAL, Univ. of Santa Clara, Graduate School, *Santa Clara, California* 95053 (NSG 2275)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0005, METEOROLOGICAL RESEARCH

R. ALBERTY, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8C370408)

PROJECT OBJECTIVE: To improve weather forecasts and storm warning by developing realistic models of storm processes and phenomena through merger of observations and experimental analogues and through numerical combinations of observational data with physical principles.

CURRENT YEAR PLAN: In addition to ongoing work in conceptual/numerical/mathematical modeling of convective processes designed to elucidate mesoscale processes, observed internal storm flows will be combined with data from external sensors to further understanding needed to incorporate real data into modeling efforts. Cases of tornado generation will be combined with other observational studies.

PROGRESS REPORT: Investigations have revealed a consistent relationship between observed circulations within severe thunderstorms and tornado genesis. These results, combined with modeling efforts, have led to a cooperative experiment to evaluate the usefulness of Doppler radar in the public warning systems.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0006, GRAVIMETER-GRAVITY EXPERIMENTS - TELESCOPE DEVELOPMENT

J. FALLER, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Boulder, Colorado* 80302 (2741271)

PURPOSE: The three projects described here (denoted as a, b, & c under the various headings) all involve advancing the state-of-the-art using precision measurement techniques. a. By advancing the state-of-the-art in absolute gravity measurements, provide a valuable new tool for geodynamics. b. Develop and disseminate new procedures & techniques for absolute and high-precision gravity experiments which traditionally have utilized (and been limited by) a conventional torsion fiber. c. Develop a new type of low-cost telescope which will have application to satellite and laser ranging, stellar spectroscopy, photometry and point source astronomy.

OBJECTIVES: Construct and evaluate a transportable absolute gravimeter capable of measuring the local accelerations of gravity with a few parts in 10 to the 9th power (which corresponds to a height sensitivity of approximately one cm.). b. Apply newly developed techniques to two important gravitational experiments, the determination of G and new Eotvos experiment by utilizing the experimental freedom (in choice of scale of the apparatus, etc.) permitted by these new techniques to improve on the present accuracies of these two experiments. c. Design and bring into operation a new type of multi-lensed large-aperture (80') telescope designed for absolute pointing at the several second of arc level.

FY77 MILESTONES: a. Complete design study & have working model of improved dropped object by Fall of 1977. b. Review existing data on performances of apparatus used for measurement of gravitation constant G & the equivalence of gravitational & inertial mass to determine whether future effort would yield significant improvement in results. Explore applicability of 'zero expansion' fluid to fiber problem--of particular interest is potential freedom from temperature gradient effects. c. Bring telescope into full-scale operation.

ACCOMPLISHMENTS: a. Some (theoretical) design progress has been made involving a variation on & what looks like a substantial improvement in the falling member design used in the easily movable (5 in 10th to the 8th power) absolute gravimeter which was developed for AFGL. b. Projects were to a high degree on inactive status in deference to completion of telescope (reprogrammed effort) and consideration of ther possible techniques. (Text abridged.)

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

5.0007, SPACE ENVIRONMENT SERVICES CENTER

G.R. HECKMAN, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8DJ32080)

OBJECTIVE: Provide real time space environment services (observations and forecasts) to satisfy the national needs and those unique needs associated with national and international programs.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0008, ATMOSPHERIC TRANSFER AND SHIELDING PROPERTIES IN THE 50 TO 75 GHZ BAND 12233-GS

H.J. LIEBE, U.S. Dept. of Commerce, Inst. for Telecomm. Science, *Boulder, Colorado* 80302 (DA0E8922)

To conduct a comprehensive experimental and analytical study of the atmospheric microwave spectrum of oxygen (O sub 2-MS) to provide reliable data on the spectroscopic parameter of O sub 2 within the frequency range of approximately 50 to 75 GHz. The availability of reliable atmospheric propagation data for millimeter waves is essential for planning of future Army communication, navigation, radar and meteorological satellite radiometric systems. USAECOM has a 65 GHz communication link under exploratory development.

The approach involves laboratory measurements covering the full range of meteorological variables from the surface to 100 km altitude. A computer-controlled pressure-scanning spectrometer will be used for obtaining the intensity distribution (attenuation, dispersion) of the oxygen microwave spectrum. Analytical approaches also are necessary for the prediction of the shielding and transfer properties of the earth's atmosphere.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

5.0009, LIDAR WIND MEASURING SYSTEM
P.A. MANDICS, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (RAA74224)

PROJECT OBJECTIVE: Study the feasibility of a satellite-borne coherent pulse lidar system to measure global atmospheric winds.

CURRENT YEAR PLAN: Study atmospheric effects (turbulence, attenuation, etc.) on lidar system performance. Perform computer simulations to evaluate expected system capabilities. Test existing ground-based lidar systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0010, RESEARCH IN AIR POLLUTION METEOROLOGY
L.E. NIEMEYER, U.S. Dept. of Commerce, Meteorology Laboratory, *Boulder, Colorado* 80302 (D7-0305; G603A-AA-09)

The research effort includes the continuing development, evaluation, and validation of air quality simulation models, both for inert and reactive pollutants. Users will be provided access to these models through the EPA User's Network for the Applied Modeling of Air Pollution (UNAMAP). New concepts and technologies will be developed and adapted for improving the weakest components of existing models, with emphasis on the effects of topography, pollutant removal and conversion processes, and complex sources. Other activities will be directed toward the determination and definition of the effects of pollutant emissions on visibility, weather and climate. Further studies will be conducted in air pollution potential climatology.

Participation will continue in the Regional Air Pollution Study (RAPS). The field portion of the study will terminate in Spring, 1977, and analysis and use of the data for model evaluation and verification will be initiated.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0011, RESEARCH IN AIR POLLUTION METEOROLOGY
L.E. NIEMEYER, U.S. Dept. of Commerce, Meteorology Laboratory, *Boulder, Colorado* 80302 (D7-0305; G603A-AA-01)

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SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0012, OPERATIONS AND TECHNOLOGY TRANSFER
K.E. WILK, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8C370404)

PROJECT OBJECTIVE: Using subsynoptic and mesoscale conventional meteorological sensors, provide continuous measurements of temperature, pressure, moisture, and wind conditions in the boundary layer during the Laboratory's severe storm observational programs. Develop and implement the necessary operating and quality control procedures to support the rawinsonde and tall tower (500 m) facilities, which together provide detailed vertical profiles of meteorological conditions in severe storm environs. Conduct research on operational use of weather radar for rapid detection and recognition of characteristics indicative of severe weather events, including hail, heavy rain, tornadoes, strong winds, and turbulence. Coordinate with other Government agencies (FAA, NWS, ERDA, etc.) to effectively define and transfer new technology developed at NSSL, to assist the operating groups of these agencies in improving their systems and procedures.

CURRENT YEAR PLAN: Continued collection and analysis of severe storm events including tornadoes, gust fronts, heavy rainfalls, hail and turbulence, analyze radar reflectivity and velocity data to determine detectability, motion, and predictability of thunderstorm hazards, and investigate use of satellite data as additional data resource.

PROGRESS REPORT: The development and testing of digital processing and recording equipment for the tower and remote sites is continuing. The characteristics of radar observations (from both conventional and Doppler radar) collected during severe storms were analyzed with concurrent aircraft, surface and tower data collected during severe storms. The first year of a planned two-year test to transfer Doppler radar technology (developed at NSSL and AFGL) to the NWS and AWS (USAF) was successfully completed. Several documents were produced from those tests and other analyses, including the development of training material for Federal Aviation Administration and the National Weather Service and research reports on potential applications.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0013, EARTH DYNAMICS SUMMER WORKSHOP ON THE APPLICATION OF SPACE TECHNIQUES TO GEODYNAMICS
M. WYSS, Univ. of Colorado, School of Arts & Sciences, *Boulder, Colorado* 80302 (NASW 3103)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0014, HALOGEN OCCULTATION EXPERIMENTS PROGRAM DEVELOPMENT
P.J. CRUTZEN, Colorado State University, School of Engineering, *Fort Collins, Colorado* 80521 (NAS 1-15129)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0015, LIGHT SCATTERING FROM IRREGULAR DIELECTRIC PARTICLES 12178-GS
G.D. WARD, State University of Fla. Sys., School of Engineering, *Gainesville, Florida* 32611 (DA0E5579; DAAG29 75 G0100)

An experimental program for measuring scattering from irregular particles whose dimensions are comparable to the incident wavelength is planned to test theoretical solutions already developed. The inverse problem of determining particle shape from scattering data also will be explored. Relevance - the results will have direct application to the ECOM ground target signature program, the design of laser systems, and in the development of atmospheric remote sensing techniques for probing of cloud microstructure and radiation exchange in the atmospheric relevant to prediction of cloud and fog formation and dissipation.

The first test of the theory will be based on measurements of optical scattering from a single tumbled particle using a differential II photometer. Scattering intensity as a function of wavelength and angle will be recorded. More complex measurements using a differential (polar) nephelometer which contains two tunable optical sources with output from 360 nm to 1000 nm will then be pursued. Measurement of scattering from various shaped and oriented particles will be made.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

5.0016, DEVELOPMENT OF GAS EXTRACTION SYSTEMS NEEDED TO PREPARE GEOLOGIC SAMPLES FOR SULFUR AND OXYGEN ISOTOPIC ANALYSIS
E.M. RIPLEY, Indiana University, Graduate School, *Bloomington, Indiana* 47401 (NSG 7389)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0017, MEASUREMENT OF STRATOSPHERIC TRACE CONTAMINANTS
A.E. LILLEY, Harvard University, Harvard College Observatory, *Cambridge, Massachusetts* 02138 (ATM75-15890 A02)

An earlier grant, ATM-7505890, funded the development of a portable millimeter wave radiometer. This instrument was adapted from an astronomical tool designed to detect a variety of chemical species in space. In its new configuration, it is intended for ground-based determinations of the altitude profiles of minor chemical species in the Earth's atmosphere.

The present grant funds the debugging, deployment, calibration, and initial observations with the instrument. Species to be observed initially are O3, CO, N2O, NO, NO2, H2O2, HNO3, C1O, and CH3C1. Calibration will be accomplished by operating in conjunction with available direct measurements. Successful operation of this instrument will add a powerful new tool for studies of the chemistry of the Earth's atmosphere.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0018, GEOPHYSICAL APPLICATIONS OF ATOMIC CLOCK RADIO INTERFEROMETRY
C.C. COUNSELMAN, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (EAR76-22615 A01)

This project is a continuation of EAR74-22712, to do experimental research on geophysical applications of very-long-baseline interferometry (VLBI). During the present grant period, the spanned radio-frequency bandwidths of the VLBI receivers will be greatly increased, and better techniques will be applied to the calibration of instrumental and propagation - medium delays. Error analyses indicate that as a result of these improvements the uncertainty in baseline determination should be reduced to 1 or 2 mm in each vector component for short (few-kilometer-long) baselines, with uncertainty increasing slowly with increasing baseline length to about 2 cm for intercontinental distances.

SUPPORTED BY U.S. National Science Foundation, Div. of Earth Sciences

5.0019, A GLOBAL STUDY OF THE VARIATIONS IN UPPER-ATMOSPHERIC COMPOSITION THAT ACCOMPANY TRANSIENT CHANGES IN THE EARTH'S MAGNETIC FIELD
L. JACCHIA, Smithsonian Institution, *Cambridge, Massachusetts* 02138 (SRF - 460117)

Through analysis of mass-spectrometer data from the ESRO-4 satellite, Dr. Jacchia plans to model the large changes in composition which accompany geomagnetically induced density variations. A preliminary model of these atmospheric variations is already designed.

SUPPORTED BY Smithsonian Institution, Smithsonian Research Foundation

5.0020, INVESTIGATION OF AURORAL PROCESS ON THE ATS FIELD LINE
R.H. EATHER, Boston College, School of Arts & Sciences, *Chestnut Hill, Massachusetts* 02167 (NSG 7385)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0021, ANALYSIS OF OPTIMUM SPECTRAL RESOLUTION AND BAND LOCATION FOR SATELLITE BATHYMETRY
F. POLCYN, Environmental Res. Inst. Mich., *Ann Arbor, Michigan* 48107 (7-722; 7-35176)

OBJECTIVE: To define the best spectral resolution and wavelength location for the measurement of depth in shallow water areas.

APPROACH: Existing optical models of oceanic bottom, water column, water surface and atmospheric effects will be integrated to a. Analyze the effects of spectral resolution in increments of 20, 40, 60, 80, and 100nm for space altitudes over the wavelength interval from 400 to 600nm. b. Examine the specific bands on the NRC/COSPEARS recommended Thematic Mapper Channels, the NASA recommended Thematic Mapper Channels and the Nimbus-G CZCS for space altitudes. c. Evaluate the effects of altitude on the channel selection for altitudes of 0, 300, 1,000, and 10,000 m at the bandwidths and resolutions defined in a and b. Atmospheric conditions will be modelled after the Kwajelein atmosphere and water conditions after Jerlov.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0022, THEORETICAL INVESTIGATIONS OF INFRARED RADIATIVE TRANSFER
S.R. DRAYSON, Univ. of Michigan, High Altitude Engineering Lab., *Ann Arbor, Michigan* 48104 (9-112; 04-6-158-44044 MOD NO. 3)

OBJECTIVE: To have accurate methods for calculating transmittances of the atmosphere in the infrared. The transmittances will be used by NOAA in retrieving temperature and constituent profiles from satellite measurements of infrared radiation.

APPROACH: The University of Michigan has developed computer programs to perform line-by-line calculations of infrared transmittances under conditions encountered in the atmosphere and in the laboratory. The calculations are sensitive to changes in spectral line parameters, such as line shapes. The work performed under this grant will be to compare these calculations with recently reported laboratory measurements. The line parameters will be revised to bring the calculations into agreement with the measurements. These results will be applied to atmospheric slant path calculations. The University will keep NOAA advised of revisions in the line-by-line programs and in the line parameters.

PROGRESS: The line-by-line program has been completed. Several alternative forms for line shape functions have been developed and incorporated into the programs. Magnetic tapes containing experimental transmittances have been received from Burch et al.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0023, RADAR BACKSCATTER STUDIES OF THE IONOSPHERE
A.E. NAGY, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (ATM75-03986 A01)

This grant funds a theoretical and incoherent scatter radar data analysis study of the atmosphere and ionosphere. In particular, it funds: 1. the development of a comprehensive numerical model of the chemistry, transport and energetics of the ionosphere and plasmasphere and comparison of the theoretical calculations with data obtained by the Arecibo backscatter facility and the Atmosphere Explorer satellites; 2. a study of the diurnal and seasonal variability of the thermospheric neutral hydrogen density as deduced from radar backscatter information; 3. a comparison between calculated and measured photoelectron escape fluxes; and 4. calculation of the radar backscatter spectra due to non-Maxwellian ion velocity distributions and an investigation of the degree to which past data interpretation schemes may have been influenced by such effects.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0024, SURVEY OF NUTRIENTS AND HAZARDOUS SUBSTANCES IN SAGINAW BAY, MICHIGAN

V.E. SMITH, Cranbrook Institute of Science, *Bloomfield Hills, Michigan* 48013 (R804442-02; N608A-029)

The distribution of major nutrients and hazardous substances in Saginaw Bay will be surveyed during 15 cruises in 1976. Objectives of the study are to: support the continuing development and verification of nutrient transport and productivity models; define the distribution and fate of hazardous substances in bay water sediments, and biota. Sampling and in situ monitoring will be conducted at 15 primary stations offshore and 5 secondary stations inshore (i.e., marsh and island littoral zones). Samples of sector, surface films, sediments and aquatic organisms will be analyzed for metals (zinc, copper, cadmium) and organic contaminants (chlorinated hydrocarbons, polynuclear aromatic hydrocarbons, phthalate esters). These and supplemental data will be used to develop a description of mass balance for Saginaw Bay. All cruises will coincide with satellite (ERTS) coverage of the area.

This work is part of a continuing EPA study of water quality dynamics in Saginaw Bay, begun in 1973.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Research Lab.

5.0025, FORMATION OF ATMOSPHERIC AEROSOLS

K.T. WHITBY, Univ. of Minnesota, School of Engineering, *Minneapolis, Minnesota* 55414 (R803851-03; G603A-AH-03)

Aerosol size distributions have been measured in the St. Louis area as part of EPA's Project MISST using aircraft and ground-based self-contained mobile laboratories. These measurements were made with a group of collaborators such that a complete array of chemical, physical, and meteorological measurements were obtained on a coal-fired power plant plume. The University of Minnesota's portion of the project included aerosol measurements aboard an aircraft and the operation of a mobile van on the ground under the plumes.

This mobile van was also operated on freeways in the Los Angeles area during October 1976 as part of an EPA-sponsored project to study sulfur aerosols on roadways.

Much of the work during the next project year will be analysis and reporting of the large amount of data obtained during the past several years. Analysis is being directed toward obtaining aerosol growth rates in the plumes, aerosol nucleation rates in the plumes and surrounding atmosphere, and toward better descriptions of the aerosol size distributions. Laboratory work toward the development of a continuous instrument for the measurement of aerosol sulfur is also being partially supported by this project.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0026, DEVELOPMENT OF TECHNIQUES FOR REMOTE MONITORING OF ORGANIC POLLUTION IN SURFACE WATERS

M. BRISTOW, U.S. Environ. Protection Agcy., Remote Sensing Division, *Las Vegas, Nevada* 89114 (J625C-72)

OBJECTIVE: The ultimate objective of this program is to develop an active airborne monitoring system capable of providing quantitative data on the concentration of total organics in surface waters.

APPROACH: The principle employed is an extension of the laboratory technique of spectrofluorometry. A water sample is irradiated with ultraviolet (UV) light of a specific wavelength and intensity, and the resultant fluorescence emission is then monitored using a monochromator-multichannel detector combination. The fluorescence signal arises from dissolved organic materials both man-made and natural in origin rather than from the water itself, which does not fluoresce. However, the water molecule emits a Raman band which, for very dilute aqueous solutions of organics, has a constant amplitude for a given intensity of excitation radiation. This water Raman emission band is then conveniently employed as a built-in reference source with which to compare the amplitude of the concurrent fluorescence emission. The normalized amplitude of the signal then provides information concerning the concentration of the dissolved organics.

CURRENT PLANS: A number of reports have been published recently which indicate that the UV-induced fluorescence emission is proportional to the concentration of dissolved organic carbon. It is planned to explore this relationship in more detail with the purpose of establishing a firm value for a correlation coefficient. Based on the findings of this correlation study, an airborne laser fluorosensor will be designed, built and tested. This system will have the capability of continuously monitoring and recording the dissolved organic carbon concentration for the surface water below the aircraft.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab.

5.0027, MONITORING SYSTEMS DEVELOPMENT FOR OPERATION APPLICATIONS (LASER FLUOROSENSOR FOR CHLOROPHYLL)

M. BRISTOW, U.S. Environ. Protection Agcy., Remote Sensing Division, *Las Vegas, Nevada* 89114 (J620A-45)

OBJECTIVE: To develop a simple airborne laser fluorosensor capable of measuring and mapping out surface water chlorophyll a concentrations for use as a eutrophic indicator for inland waters. In addition, the device can be used for monitoring fluorescent water tracing dyes.

APPROACH: The airborne laser fluorosensor employs a flashlamp pumped dye laser tuned to the absorption peak of chlorophyll a at 440 nm. The laser-induced fluorescence is then collected by a large aperture telescope and focused via a 685 nm interference filter onto a detector. Correction for variation in water transmisson is made by concurrently monitoring the laser-induced water OH stretch Raman band at 5172 Angstroms. The signal is displayed on a CRT, digitized and recorded on magnetic tape for later analysis. By making repeated passes over a given target, either in a fixed or rotary wing aircraft, it will be possible to produce a contour map of the chlorophyll fluorescence to water Raman ratio for use as an indicator of surface water chlorophyll a concentration.

CURRENT PLANS: The system is currently being evaluated in an EPA Bell Huey helicopter over Lake Mead. At a height of 1000 ft. above the surface and under full daylight conditions, good signal-to-noise ratios are obtained for surface chlorophyll concentrations of the order of 1 micron gm/1. Present plans are to compare and correlate airborne and ground truth data with a view to calibrating the airborne system.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab.

5.0028, ENERGY-RELATED OVERHEAD MONITORING AND TECHNIQUES DEVELOPMENT

R. LANDERS, U.S. Environ. Protection Agcy., Remote Sensing Division, *Las Vegas, Nevada* 89114 (J625C-71)

OBJECTIVE: Establish preliminary guidelines for and demonstration of overhead remote monitoring of western energy-related activities.

APPROACH: Cooperative western energy-related overhead monitoring program between NASA and EPA has been established with the purpose to define, demonstrate and develop operational remote sensor techniques to rapidly monitor, in a cost-effective, quantitative manner, the success with which an energy-related extraction site has been or is being rehabilitated to a state suitable for its intended or previous land usage. This includes the determination of environmental baselines for the purpose of establishing rehabilitation criteria as well as environmental effects of mine mouth power plants.

CURRENT PLANS/PROGRESS: a) Initiate baseline information studies (completed), b) Demonstration of multispectral scanner techniques using existing NASA system (completed), c) Utilizing manual photointerpretation techniques of aerial photographs, perform assessments of environmental impact and rehabilitation efforts (August 1975 - August 1976), d) Utilizing multispectral scanner (MSS) data, perform assessment of environmental impact and rehabilitation efforts (August 1975 -

December 1976), e) Photointerpretation report preparation (August 1976 - September 1976), f) MSS data report preparation (December 1976 - January 1977), g) Prepare western energy 'Atlas' (August 1976 - December 1976), h) Evaluation report (January 1977 - June 1977).

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab.

5.0029, ASSESSMENT OF AQUATIC VEGETATION WITH SATELLITE-DERIVED DATA
W.R. PHILIPSON, Cornell University, School of Engineering, *Ithaca, New York* 14850 (A-082-NY)

The proposed research will examine whether any useful information on freshwater aquatic vegetation--emergent, floating and submersed--can be derived through analysis of multispectral data acquired by the Landsat satellites. Interpretations arrived at through manual and digital analysis of Landsat images and computer-compatible tapes will be related to information derived from aerial photographs and other data sources. By focusing on Canadarago Lake and other lakes in upstate New York, the study will extend the methodologies and findings of an ongoing study in which detailed vegetative information has been derived from low-altitude aircraft photographs and field checks.

SUPPORTED BY U.S. Dept. of the Interior, Office of Water Research & Technology

5.0030, RADIOACTIVITY IN STRATOSPHERIC AIR
E.P. HARDY, U.S. Energy Res. & Dev. Admin., Environmental Studies Div., *New York, New York* 10014

The objectives are to document the concentrations of radioactive particulates and gases in the stratosphere as a function of latitude, altitude and season; to test stratospheric transport models and to supply basic data for other scientific programs in studying the ultimate deposition of these tracers in the environment. High-altitude balloons sample particulates at 20 to 27 km annually (spring) at 65 degrees N and 9 degrees N and three times a year at 33 degrees N. Project Airstream employs the WB-57F aircraft operated by the National Aeronautics and Space Administration as the sampling platform in the lower stratosphere. Sampling missions are scheduled for the spring, summer and fall seasons of the Northern Hemisphere. The latitude coverage extends from 75 degrees N to 10 degrees S. Four altitudes are sampled at each latitude ranging from 12 km in the polar region to a maximum of 19 km. The balloon and aircraft filters are analyzed by Ge(Li) diode spectrometry for Be-7, Zr-95, Cs-137, and Ce-144 and radiochemically for Sr-90, Pb-210 and Pu-239,240. Carbon dioxide collections on molecular sieve samplers are made on all balloon flights for C-14 measurements by Argonne National Laboratory under the direction of the Air Resources Laboratory of NOAA. Gaseous samples from aircraft flights are analyzed for C-14 three times a year and for Kr-85 annually by McClellan Central Laboratory. A separate gas sampling system operated by the Univ. of Miami provides HT information.

RESULTS: Atmospheric nuclear weapons testing over the past eight years has maintained a fission product burden in the stratosphere equivalent to several hundred kilocuries of Sr-90. The composition of this debris which eventually deposits on the earth's surface has followed the expected production quantities.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Biomedical & Environmental Research

5.0031, LATERAL VARIATIONS IN GEOLOGIC STRUCTURE AND TECTONIC SETTING FROM REMOTE SENSING DATA
S.S. ALEXANDER, Penn. State University, School of Earth & Min. Sci., *University Park, Pennsylvania* 16802 (DF048870; AF-AFOSR-3340-77)

AF function - DoD has as one of its missions to improve the U.S. capability for the detection and identification of underground nuclear explosions. Deficiency - the knowledge on how different geological structures affect the yield determinations of underground nuclear explosions is only known to factor ratio of three to five. To adequately monitor the Threshold Test-Ban Treaty this factor should be reduced to at least 1.5. Objective - the principal objective of this research is to assess the usefulness of remote sensing digital imagery (LANDSAT multispectral scanning data) for inferring lateral variations in geological structure and tectonic setting. Contribution - this research will determine the extent to which these inferred variations correlate with observed variations in seismic excitations from underground nuclear explosion for the various test sites in the Soviet Union.

The research will take advantage of the unique capabilities available in the Office of Remote Sensing of Earth Resources (ORSER). The principal types of digital analysis proposed include: (1) classification mapping of soils and vegetation using supervised and/or unsupervised cluster analysis, (2) principal components and canonical analysis, (3) wave-number analysis to determine the predominant scale and orientation of distinctive patterns, (4) wave-number filtering to enhance and map features of any desired spatial dimension and orientation, and (5) spatial and temporal derivative operations to map zones of rapid change. A variety of signal enhancement techniques are available if needed. The most promising technique will be developed into a composite processing package for application to any desired geological structure on global basis.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NP, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0032, ESTIMATION OF SHORT-WAVE AND LONG-WAVE RADIATION FOR CLIMATIC MODELS
J.J. CAHIR, Penn. State University, School of Earth & Min. Sci., *University Park, Pennsylvania* 16802 (8-414; 04-6-158-44013 MOD. NO. 5)

TECHNICAL OBJECTIVE: The objective of this research project is to provide statistical techniques from which albedo and infrared radiation, over the oceans, escaping into space can be estimated as a function of variables normally available in numerical climatic models.

APPROACH: The techniques will be based on statistical analysis of conventional and satellite data that were successfully utilized to develop the over-land regression model. Statistical relations will be sought between long- and short-wave radiation, as estimated from satellites and hydrodynamic data such as stability, humidity, vertical velocity, etc. Based on these relations, multiple regression equations can be developed for the estimation of infrared radiation and atmospheric reflectivity directly from the hydrodynamic variables. The plan calls for the examination of radiational behavior of low clouds over the oceans near the United States such as NE Atlantic and Eastern Pacific. In addition, a pilot study of the application of the over-land regression equations to prediction of cloudiness-related phenomena will be conducted.

PROGRESS: Regression equations which provide predictions of short-wave albedo over continents in winter, with variables from grid-point-type primitive equation models as predictors have been developed. This, combined with the long-wave results of the previous year, provides a technique for predicting the net radiation over continents in winter from such models. The model results will be published in the January 1978 issue of Quarterly Journal of the Royal Meteorological Society. Work on albedo and infrared radiation over land in summer are in satisfactory progress, and completion is expected before the termination of the current contract.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0033, AERONOMY OF THE STRATOSPHERE AND MESOSPHERE 12589-GS
L. HALE, Penn. State University, School of Engineering, *University Park, Pennsylvania* 16802 (DA0E8998; DAAG29 75 G0031)

To better understand the composition of the upper stratosphere and mesosphere and the coupling of this composition with the electrical structure of this region and with lower level

meteorological parameters. The determination of the composition of the nuclearly undisturbed atmosphere is basic to the prediction of atmospheric effects upon communications, surveillance, and ballistic missile defense systems. The work directly supports research programs at the Atmospheric Sciences Laboratory and the Ballistic Research Laboratories.

The research involves instrumentation, observation, and analysis phases. Measurements of the oxides of nitrogen and the electrical structure of the upper stratosphere and mesosphere will be made using parachute and balloon-borne probes.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

5.0034, PERFORM A SENSITIVITY ANALYSIS ON ALGORITHMS USED TO QUANTIFY POLLUTANT DISTRIBUTIONS IN COASTAL WATERS USING REMOTELY SENSED DATA

P.C. CORNILLON, Univ. of Rhode Island, Graduate School, *Wakefield, Rhode Island* 02881 (NSG 1461)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0035, EXPANDED DEVELOPMENT OF HETERODYNE DETECTOR SYSTEMS FOR MEASUREMENT OF ATMOSPHERIC TRACE CONSTITUENTS

E.C. KINDLE, Old Dominion University, School of Sciences & Health, *Norfolk, Virginia* 23508 (NSG 1466)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0036, RESEARCH AIRCRAFT OPERATIONS

P.M. POTTER, Battelle Memorial Institute, *Richland, Washington* 99352 (EY-76-C-06-1830)

The purpose of this program is to provide technical support for ERDA-DBER Atmospheric Research Programs in the form of airborne laboratories and tracer-release facilities. The aircraft carry necessary instrumentation for highly sophisticated measurements of cloud physics, aerosols, pollutant gases, atmospheric tracers and turbulence. Aircraft support is required for the following Atmospheric Science Programs: Precipitation Scavenging, Atmospheric Boundary Layer Studies, Particle Resuspension and Translocation, Cooling Tower and Cooling Pond Studies, Atmospheric Impact Studies, Aerosols and Trace Gas Transformation, and Urban Pollution and Tracer Studies.

RESULTS: The aircraft have been used for tracer release and in-cloud sampling in scavenging experiments at Quillayute, WA. The second aircraft, a DC-3, has been heavily instrumented, including a sophisticated data acquisition system with computer. In METROMEX the aircraft have been used for in-storm tracer experiments and Lagrangian aerosol transformation studies. They have also been used for resuspension studies and for studies of plumes from major cities and from nuclear power plants. Smoke plumes from fires have been sampled to determine the significance of fires on resuspension of surface fallout of radionuclides.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Biomedical & Environmental Research

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, RESEARCH OF BIOENGINEERING AND VIBRATION PROBLEMS MEDICALLY SIGNIFICANT TO ARMY AVIATION

J.R. GEARHART, U.S. Army, Bioeng. & Life Spt. Equip. Div, *Ozark, Alabama* 36362 (DA0E6733)

To determine the short-term clinical effect of helicopter vibration on the musculoskeletal system and to develop an orthopaedically, anthropometrically sound helicopter crew seat to reduce vibration effects.

Prospective clinical and epidemiologic study using physical examination subjective reporting forms, Norland bone mineral analysis, biochemistry, and X-ray techniques. Seat design and validation will be accomplished statically and dynamically on a three degree of freedom, man-rated vibration table using dynamic EMG techniques. Pilot performance and efficiency are studied. Animal models are used and the techniques of tetracycline bone labeling and scanning electron microscopy of the joint surfaces are employed.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0002, DIRECT FIELD RESEARCH SUPPORT TO IMMEDIATE ARMY AEROMEDICAL PROBLEMS (02)

S.C. KNAPP, U.S. Army, Bioeng. & Life Spt. Equip. Div, *Ozark, Alabama* 36362 (DA0D6734)

Provide US Army aviation with sound and timely bioengineering information to solve operational problems generated in the interface of the physical and life sciences.

The techniques employed will vary, depending on the problem area, but will be based on sound accepted experimental methodology designed to provide the required information as expeditiously as possible.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0003, AVIATION MEDICINE RESEARCH FOR AIRCREW SELECTION, RETENTION AND PHYSICAL PERFORMANCE STANDARDS

F.S. PETTYJOHN, U.S. Army, Aviation Medicine Res. Div., *Ozark, Alabama* 36360 (DA0B6895)

To provide the US Army information concerning the medical requirements for Army aircrew selection, retention, and physical performance.

To apply accepted medical research methodology and technology to accomplish the objective.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0004, UTILIZATION OF LIGHT ENERGY BY HALOBACTERIUM HALOBIUM

L. PACKER, Univ. of California, School of Letters & Science, *Berkeley, California* 94720 (NCA 2-50801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0005, AERONAUTICAL TECHNOLOGY, TECHNICAL AREA M - AVIATION HUMAN ENGINEERING

I.C. STATLER, U.S. Natl. Aero. & Space Adm., Ames Research Center, *Moffett Field, California* 94035 (DA0E3520)

Improve Army air mobility systems by providing improved knowledge, criteria and technology for man-machine integration and by providing better engineering methods for performing the AVSCOM man-machine integration functions.

Systematic exploratory R&D in human performance technology, flight simulation methods and requirements, control and display technology, and man-machine dynamics. The approach emphasizes analytical and experimental studies using laboratory, simulation, mathematical modeling and flight test facilities. These activities have been coordinated with and will complement and support the handling qualities R&D of technical area A and the flight simulator development of technical area K. Objectives will be achieved largely through joint participation with NASA, making maximum use of the facilities and expertise available within NASA for man-machine systems research.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

6.0006, RENAL RECEPTORS AND SIMULATED WEIGHTLESSNESS
D. FELDMAN, Stanford University, School of Medicine, *Palo Alto, California* 94305 (NCA 2-745802)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0007, METHODS OF CALCULATING MOLECULAR INTERACTION ENERGIES FROM DATA GENERATED BY THE AIMS GRAPHICS SYSTEM
G.B. LOEW, Stanford University, School of Medicine, *Palo Alto, California* 94305 (NCA 2-745721)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0008, TYPE II INTERFERON AND SUSCEPTIBILITY TO DISEASE
T. MERIGAN, Stanford University, School of Medicine, *Palo Alto, California* 94305 (NCA 2-745801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0009, REGULATION OF CALCIUM METABOLISM IN HYPODYNAMIC MONKEYS
D. NAGEL, Stanford University, School of Medicine, *Palo Alto, California* 94305 (NCA 2-745804)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0010, AUTOGENIC-FEEDBACK TRAINING OF HUMAN AUTONOMIC RESPONSE PATTERNS TO SUPPRESS MOTION SICKNESS SYMPTOMS
J. KAMIYA, Univ. of California, Graduate School, *San Francisco, California* 94122 (NCA 2-665710)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0011, AMELIORATION OF MUSCLE PROTEIN DEGRADATION
G.L. SEARLE, Univ. of California, Graduate School, *San Francisco, California* 94122 (NCA 2-665801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0012, THE ADSORPTION OF BASES, NUCLEOSIDES, AND NUCLEOTIDES ON HOMOMETALLIC CLAYS
M.A. SWEENEY, Univ. of Santa Clara, School of Science, *Santa Clara, California* 95053 (NCA 2-685801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0013, SATELLITE TECHNOLOGY IN BIOMEDICAL COMMUNICATION
W.G. COOPER, Univ. of Colorado, School of Medicine, *Denver, Colorado* 80220 (N01OD72120 (CONTRACT))

SUPPORTED BY U.S. Dept. of Health Education & Welfare, National Inst. of Health, National Inst. of Health Directors Office

6.0014, ADVANCED DOSIMETRY CONCEPTS
H.J. SCHAEFER, State University of Fla. Sys., Graduate School, *Pensacola, Florida* 32504 (NAS 9-15417)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0015, DEVELOPMENT OF LIMB VOLUME MEASURING SYSTEM
J.F. LAFFERTY, Univ. of Kentucky, School of Engineering, *Lexington, Kentucky* 40506 (NAS 9-15452)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0016, PSYCHOMETRIC MODELING OF THE HUMAN INFORMATION PROCESSING DEMANDS OF INTERACTIONS WITH AVIONIC COMPUTERS
R.A. CHECHILE, Tufts University, School of Arts & Sciences, *Medford, Massachusetts* 02155 (NCA 2-785801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0017, FRACTIONATION AND ENRICHMENT OF SPECIFIC DNA SEQUENCES FROM EUKARYOTIC GENOMES
J. PAPACONSTANTINO, U.S. Energy Res. & Dev. Admin., Biology Division, *Oak Ridge, Tennessee* 37830 (W-7405-ENG-26)

Binding of the heavy metals, Ag and Hg, to DNA has been used for the fractionation of specific DNA sequences such as satellites, and structural genes from complex eukaryotic genomes. The fractionation is based on the specific interaction of the metal ion with either A.T or G.C rich regions of the genome, thus changing the buoyant density of the metal complexed DNA in Cs2SO4 gradients. In most of these studies the reactions were carried out at alkaline pH. Since the specificity of binding of Ag to G.C or A.T rich sequences is pH dependent, the potential for the use of Ag in the fractionation of eukaryotic DNA at acid pH has not been exploited. Experiments have been done to show the variation in sedimentation properties of rabbit, calf and mouse DNA in Ag-Cs2SO4 gradients at acid, neutral and alkaline pH and to apply this procedure to the isolation of rDNA and tDNAPhe as well as a variety of satellite DNAs.

RESULTS: At pH 5.5, 6.0, and 7.0, Ag binds specifically to high G.C sequences of calf, rabbit, and mouse DNA. These Ag-DNA complexes are easily separated from the rest of the DNA in Cs2SO4 gradients. We have isolated a variety of G-C satellites, rDNA, and tDNAPhe from calf DNA and rDNA from rabbit and mouse DNA using this procedure.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Biomedical & Environmental Research

6.0018, EARLY DETECTION OF DISEASE BY EVALUATION OF THE CELLULAR IMMUNE RESPONSE
B.S. CRISWELL, Baylor College of Medicine, School of Medicine, *Houston, Texas* 77025 (NAS 9-15457)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0019, THE INTERACTION OF OXYGEN AND GRAVITY INFLUENCED LIGNIFICATION
J.R. COWLES, Univ. of Houston, School of Arts & Sciences, *Houston, Texas* 77004 (NSG 2279)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0020, ANALYTICAL METHODS FOR ENVIRONMENTAL ASSESSMENT OF VOLATILE NITROSAMINES
J.P. CONKLE, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF320880)

This work unit will develop, test and evaluate sorbent and extractive sampling methods for detection and quantitative measurement of N-nitrosodimethylamine (NDMA) in ambient air, soil and water media. NDMA is an intermediate in the industrial synthesis of unsymmetrical dimethylhydrazine (UDMH) rocket fuels, and is one of the carcinogenic compounds controlled by OSHA. This development effort is essential to provide cost-effective sampling/analysis procedures to ensure environmental safety of continued UDMH production. This effort supports the AFLC (SAALC/SF) procurement of UDMH rocket fuel. This effort was previously documented under 7164-16-27.

Cold-trap, impinger and sorbent tube NDMA-sample collection methods will be compared against various analytical procedures including wet chemistry, chromatography, and chemiluminescence (thermal energy analysis) to establish an artefact-free referee method for air, water and soil media. Standardized sampling methods will be transitioned to the Air Force Occupational and Environmental Health Laboratory (OEHL) for routine air monitoring in FY 77, and for routine soil/water monitoring in FY 78.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0021, VALIDATED TEST PROCEDURES FOR THE ACCEPTANCE AND OVERHAUL OF OXYGEN DELIVERY EQUIPMENT
R.D. HOLDEN, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF323170)

Current test procedures for the acceptance and overhaul of oxygen delivery systems utilize antiquated test equipment that does not realistically represent the user's respiratory needs. The increasing complexity of life support equipment dictates that testing and overhaul procedures keep pace with new methods and technological advancements. A logical starting point in the upgrading of present test procedures would be consideration of criteria from the standpoint of actual user respiratory need. In FY 78-79 validated procedures for the testing of oxygen regulators for acceptance and, after overhaul, will be provided to Oklahoma City ALC as a basis for test equipment that truly represents the very broad spectrum of individual respiratory requirements. Previously documented under 79301307.

Quality control, overhaul methodology, functional testing and life cycle cost are essential considerations in the development process. Through a close continual relationship between development and logistics organizations optimal performance criteria can be developed. Current liaison with Oklahoma City and San Antonio ALCs will be nurtured and become more extensive in the future. The oxygen regulator test stand with its various components, the human breathing/metabolism simulator and the analytical data acquisition and control system will be the primary equipment utilized in this effort. It is anticipated that with equipment of this sophistication level a wealth of data can be acquired and developed not only for recommendations, but also for creation of realistic operational performance standards. Through cooperative efforts and interface guidance with the two ALCs, validated test procedures for the acceptance and overhaul of oxygen delivery equipment can be accomplished.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0022, EEG ABNORMALITIES AND NEUROLOGIC SEQUELAE
J.J. ROBIN, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF321700)

The objective is to refine the definition of normal/abnormal states and apply these data to flying personnel on a short and prolonged basis. Certain electroencephalographic phemonema seem correlated with clinical conditions and occur after such events as head trauma. But the meaning of these findings in asymptomatic individuals with no relevant history and normal physical findings is uncertain. Long-term followup of a group of subjects with these findings is indicated in order to study the meaning of these EEC phenomena in otherwise normal individuals.

All aircrew undergoing evaluation by the Aeromedical Consultation Service routinely have electroencephalography with hyperventilation and photic drive. Additionally, sleep-deprived EEGs are obtained if there is any evidence of abnormality which is not clearly disqualifying for flying duties. EEGs are interpreted in accordance with Air Force aircrew standards and those subjects not meeting those standards are disqualified for flying duties. All of the last 100 such EEGs will be reviewed by the primary investigator for accuracy of interpretation. An attempt to reach the subjects involved will be made by mailing them questionnaires to assess their current clinical status and job experience. Similar questionnaires will be mailed to a matched group with normal EEGs. Data will be analyzed to differentiate those findings which are predictive of disability for flying duty. This effort was formerly documented under work unit 7755-04-08.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine NG, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0023, MICROWAVE EFFECTS
T.J. TREDICI, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF323050)

The objective of this unit is to provide detailed initial ophthalmologic evaluation and follow-up, as clinically indicated, for those USAF personnel who have suffered a microwave overexposure, i.e., normally those calculated to have been exposed to greater than twice the permissible exposure limit (PEL). This work is further directed by Air Force regulation 161-42. Finally, attention will be focused on the presence or absence of lenticular lesions and their possible causal relation to the microwave exposure.

Patients will be evaluated in the Ophthalmology Branch, Clinical Sciences Division, following standard patient evaluation protocols. Follow-up over time will be established on an individual basis and reports will be made to the referring physician and medical facility. When sufficient data have been accumulated, scientific publication of the material will be made in scientific journals. Work was formerly documented under work unit 77550905.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine NG, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0024, CAROTID ARTERIAL BAROREFLEX MECHANISMS
D.L. ECKBERG, Virginia Commonwealth Univ., Graduate School, *Richmond, Virginia* 23219 (NSG 9063)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, AN ALGORITHM FOR COMPUTER-ASSISTED SEQUENCING OF TERMINAL AREA OPERATIONS
R.G. DEAR, Calif. State Univ. & Colleges, Graduate School, *Fullerton, California* 92631 (NCA 2-253702)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

7.0002, DATA REDUCTION AND ANALYSIS OF THE ENVIRONMENTAL MEASUREMENT EXPERIMENT
R.L. ARNOLDY, Univ. of New Hampshire, School of Technology, *Durham, New Hampshire* 03824 (NAS 5-24328)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

7.0003, TRAPPED ORBITS IN A MAGNETIC DIPOLE FIELD AND THE STABILITY OF THE VAN ALLEN RADIATION BELT
M. BRAUN, City University of New York, Graduate School, *Flushing, New York* 11367 (MCS77-03999)

M. Braun will show that a magnetic dipole field can trap particles for arbitrarily long time periods. Specifically, he will show that the phase space of a particle moving under the influence of a magnetic dipole field contains regions where particles are trapped forever. This will be accomplished by proving the existence of infinitely many invariant tori of non-zero measure on each surface of sufficiently high energy and constant electromagnetic angular momentum. Any orbit starting between two such tori must remain trapped for all future time. These results will be applied to the earth's magnetic field to show that particles of sufficiently high energy to be physically interesting can be trapped forever.

SUPPORTED BY U.S. National Science Foundation, Div. of Mathematical & Computer Sciences

7.0004, JOINT USE OF RESOURCES FOR DEMONSTRATION OF A MOBILE DATA ANALYSIS STATION
G.R. MILLER, Oregon State Higher Educ. Sys., Environ. Remote Sensing Lab., *Corvallis, Oregon* 97331 (NCA 2-586801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

7.0005, INTERACTIVE GRAPHICS SOFTWARE/TECHNIQUES DEVELOPMENT
F.J. STOCKER, Penn. State University, Graduate School, *University Park, Pennsylvania* 16802 (NAS 9-15427)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

7.0006, INITIAL INVESTIGATION INTO THE DEFINITION OF SUBSETS FOR RESTRICTED COMPUTER ARCHITECTURES
T.W. PRATT, Univ. of Virginia, Graduate School, *Charlottesville, Virginia* 22903 (NSG 1458)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, AURORAL SPECTROSCOPY USING ATMOSPHERE EXPLORER OBSERVATIONS
M.H. REES, Univ. of Alaska, School of Environmental Sci., *Fairbanks, Alaska* 99701 (NSG 5219)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0002, NEW EFFECTS IN MULTIPHOTON ATOMIC AND MOLECULAR PROCESSES
P.P. LAMBROPOULOS, Univ. of Southern California, School of Letters Arts & Sci., *Los Angeles, California* 90007 (PHY76-23163 A01)

Research on multiphoton processes initiated under NSF grant PHY74-17553 (University of Texas) will be continued and extended. Among the specific areas in which research will continue are atomic structure calculations, electric quadrupole effects, photon correlation effects, optical pumping effects, light-polarization and electron spin-polarization effects, and resonance effects.

In addition, the previous effort will grow in a number of new directions, including phenomena related to resonant harmonic generation, strong field effects, and resonance multiphoton processes. These investigations will deal with basic aspects of multiphoton processes as well as their application to spectroscopy, laser isotope separation and ionization under very strong fields.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0003, GEOMAGNETIC MICROPULSATIONS
V.L. PATEL, Univ. of Denver, School of Arts & Sciences, *Denver, Colorado* 80210 (ATM75-16785 A01)

This grant funds a theoretical and data-analysis study of geomagnetic micropulsations in the magnetosphere and their propagation to the surface of the earth. Existing satellite data will be correlated with observations at the earth's surface. The characteristics of the hydromagnetic waves that appear as micropulsations will be studied, including the effects of the plasma density at the magnetopause, the wave frequencies that are excited, the wave polarizations, and the orientations of the polarization ellipses. This work will help understand a variety of phenomena that occur in the magnetosphere and their manifestations at the earth's surface.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

8.0004, THERMAL AND ULTRASONIC TRANSPORT PROPERTIES OF DIELECTRIC AND PIEZOELECTRIC SOLIDS 11717-P
P.G. KLEMENS, Univ. of Connecticut, Graduate School, *Storrs, Connecticut* 06268 (DA0D9227; DAHC04-74-G-0068)

To study experimentally the effect of lattice defects on the thermal conductivity and attenuation of both bulk and surface ultrasonic waves of a number of dielectric crystals. Improvement of an understanding of phonon interactions is highly relevant to the operation of solid-state devices. The establishment of some additional properties of radiation-induced defects in dielectrics remains a definite possibility promising applications in the nuclear hardening domain. The program is also responsive to current trends in surface wave technology since crystals of interest will be studied. Study of the attentuation of surface waves should provide knowledge of the structure of surfaces which could be useful as direct guidance for ECOM programs in surface wave materials and devices.

The role of anharmonic phonon interactions and of phonon-defect interactions will be elucidated by comparing the effects of defects on the thermal conductivity and the ultrasonic attenuation. Methods will be improved to measure the attenuation of surface waves, and these measurements will be used to study the defect structure of surfaces, with emphasis on radiation damage. Theoretical studies will be carried out to support these experiments, and to investigate radiative heat transfer in composite structures and the propagation of elastic surface wave signals over irregular surfaces.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

8.0005, MICROWAVE AND SUBMILLIMETER WAVE INVESTIGATION OF THE DIELECTRIC CONSTANT IN

SEMICONDUCTORS WITH SYMMETRY-INDUCED ZERO ENERGY GAP
J.K. FURDYNA, Purdue University, School of Science, *Lafayette, Indiana* 47907 (DMR77-00034)

The objective of this experimental research program is to measure the static dielectric constant of semiconductors with a symmetry-induced zero energy gap, and to determine its dependence on external parameters. In semiconductors belonging to this class the dielectric constant is theoretically predicted to have an anomalous behavior resulting from an inter-band contribution, which in pure materials at very low temperatures approaches a singularity. Microwave and millimeter wave propagation in these materials, in the presence of an external dc magnetic field, is under certain conditions strongly dependent on the static dielectric constant. These wave propagation effects will be used to measure the value of static dielectric field, on composition, on hydrostatic pressure, and on the direction which the magnetic field makes with the crystallographic axes.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0006, GLOBAL AURORAL IMAGING AT VISIBLE AND ULTRAVIOLET WAVELENGTHS FOR THE DYNAMIC EXPLORER
L.A. FRANK, Univ. of Iowa, School of Liberal Arts, *Iowa City, Iowa* 52240 (NAS 5-24293)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0007, PLASMA WAVE EXPERIMENT FOR THE DYNAMIC EXPLORER
S.D. SHAWHAN, Univ. of Iowa, School of Liberal Arts, *Iowa City, Iowa* 52240 (NAS 5-24294)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0008, DEFINITION OF INSTRUMENTS FOR AN EJECTABLE PLASMA DIAGNOSTICS PACKAGE FOR SKYLAB MISSION
UNKNOWN, Univ. of Iowa, Graduate School, *Iowa City, Iowa* 52240 (NAS 8-32807)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0009, PHYSICAL AND CHEMICAL PROPERTIES OF ORDERED FLUIDS
P.S. PERSHAN, Harvard University, School of Arts & Sciences, *Cambridge, Massachusetts* 02138 (DMR76-22452 A01)

This program, which has been active in the physics and chemistry of ordered fluids for several years, is being extended into new directions in response to past progress and newly perceived opportunities. Earlier work on the effects of electric and magnetic fields on curvature elasticity in nematic phases in being extended to studies of field effects on conventional thermotropic smectics, lyotropic smectics consisting of alternate lipid bilayers and water, chiral smectics exhibiting ferroelectricity and thin films. Past research into the mechanical, thermodynamic and hydrodynamic properties of simple one component nematic and smectic liquid crystals in being extended into more complex phases, including the biologically relevant lipid water systems. Techniques such as Raman, Brillouin and Rayleigh scattering that have profitably been applied to ordered fluids in the past will be continued.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0010, STUDY OF HIGH-DENSITY, HIGH-FIELD POWER REACTORS
D.R. COHN, Mass. Inst. of Technology, Francis Bitter Natl. Mag. Lab., *Cambridge, Massachusetts* 02139 (EG-77-S-02-4183)

The operation of demonstration reactor at high density (n equals 3 -5 times 10 to the 14th power per cubic centimeter) offers the attractive possibility of attaining ignition in a relatively small (a equals 1.2m) device characterized by moderate output power level (equals 800 MWel) and by relatively high fusion power density (is approximately equal to 10 MW/cubic meter). In addition, experimental results in Alcator indicate that high-density operation may be of significant value in controlling impurities. Based upon present MHD codes the value of toroidal beta may be limited to 4-6% for D shape plasmas with aspect ratios of 4-5. Hence high field (6-8 T on the plasma axis) are needed for high-density operation. The proposed study will investigate the unique engineering and physics problems of high-density, high-field reactors. Particular emphasis will be given to developing designs for modularized high-field magnet systems and to investigating the engineering of a neutral beam injection system using asymmetric ripple assisted injection.

RESULTS: In FY'77 a scoping study of a high-density, high-field demonstration reactor was performed and preliminary design for a high-field compact tokamak reactor (HFCTR) was formulated.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Magnetic Fusion Energy

8.0011, NEUTRAL ATMOSPHERE COMPOSITION EXPERIMENT FOR THE DYNAMIC EXPLORER
G.R. CARIGNAN, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (NAS 5-24295)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0012, FABRY-PEROT INTERFEROMETER FOR THE DYNAMIC EXPLORER
P.B. HAYS, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (NAS 5-24296)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0013, NUCLEAR PHYSICS PROGRAM
S.M. AUSTIN, Michigan State University, School of Natural Sciences, *East Lansing, Michigan* 48824 (PHY76-02206 A03)

This grant will provide funds to intensify work on the superconducting cyclotron design project. Studies will be made of radio frequency systems and ion sources to insure that such systems will be compatible with the superconducting magnet now nearing the test stage. Full-scale low-power models of the DEE system and RF amplifier will be tested. A full-power test of a mock-up of the sliding short will be carried out and a facility for D.C. testing of ion sources in the magnetic field will be designed and built. These studies, along with the magnet studies, are required to establish complete proof of the feasibility of the superconducting cyclotron concept.

This work is a continuation of that currently supported by Foundation grant PHY76-02206 AO2.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0014, EXPERIMENTAL STUDY OF THE ELECTRONIC PROPERTIES OF LIQUID TRANSITION METALS AND TRANSITION-LIKE METALS
J.B. VANZYTVELD, Calvin College, Undergraduate School, *Grand Rapids, Michigan* 49506 (DMR77-05213)

The electronic properties of solid and liquid transition metals and transition-like metals will be investigated experimentally at high temperatures. Experiments include the measurement of the resistivity and thermopower of high-purity calcium, strontium,

europium and ytterbium from room temperature to above the melting point. Also, experiments will be done to measure the resistivity of liquid 3-d transition metals and the resistivity and thermopower of strontium-barium alloys. The results of these experiments will be used to test recent theoretical work on liquid metals.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0015, THEORETICAL STUDIES OF SPIN CORRELATION FUNCTIONS
P.A. FEDDERS, Washington University, School of Arts & Sciences, *St. Louis, Missouri* 63130 (DMR77-06719)

A theoretical program of four partially overlapping categories will be carried out: 1. The study of time-dependent spin correlation functions for systems of strongly interacting spins in the high temperature limit. These studies are based on first principles microscopic equations of motion and should elucidate our understanding of dynamical interactions in spin systems. 2. The development and application of a recently discovered formalism for treating the hopping of vacancies, impurities, and interstitial hydrogen in crystal lattices. This formalism is applicable to correlation functions measured in neutron scattering and magnetic resonance experiments in systems where the hopping rates between members of a pair of sites are asymmetric. 3. The further study of the effects of impurities and other crystal defects on measurable spin correlation functions. The proposed work in this category attacks the important problem of how one can quantitatively study crystal defects. 4. The study of basic spin-phonon interactions and their effects on spin lineshapes and on acoustic velocity and attentuation.

This is a continuation of research supported under DMR7518100.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0016, AN ELECTRON PARAMAGNETIC RESONANCE FACILITY
J.E. DRUMHELLER, Montana State University, School of Letters & Sciences, *Bozeman, Montana* 59715 (DMR77-02153)

An electron paramagnetic resonance (epr) spectrometer and associated electronics will be provided for studies of magnetic materials - especially those which are ordered in less than three dimensions. The extent of the anisotropy in lower dimensional magnetic systems will be measured and the source of the anisotropy will be sought. Experiments using paramagnetic ions to measure the single ion anisotropy in compounds with layered structures will be carried out. The contribution of the exchange interaction to the type of magnetic order and the effect on the epr linewidth and lineshape will be observed with this equipment.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0017, THEORETICAL PARTICLE PHYSICS
J.B. BRONZAN, Rutgers The State University, School of Arts & Sciences, *New Brunswick, New Jersey* 08903 (PHY76-24312 A01)

Work will continue on the following areas: Reggeon Field Theory; Relation between renormalization group and Regge singularities; Calculation of scaling indices; Polarization phenomena at high energy. This work represents a continuation of that currently supported by Foundation grant PHY75-06857 AO2.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0018, EQUIPMENT FOR ULTRA LOW TEMPERATURE STUDIES
D.M. LEE, Cornell University, School of Arts & Sciences, *Ithaca, New York* 14853 (DMR77-07466)

Equipment will be purchased as part of an ongoing program to develop techniques for experimental research below 2 millikelvin. A new dilution refrigerator and a nuclear demagnetization apparatus will be constructed. Electronics will be assembled for the necessary diagnostic facilities such as temperature measurement and control. The initial research to be done with the apparatus will be a study of the superfluid phases of helium-3 but the wider goal is to open the termperature range below 1 millikelvin for all areas of physics.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0019, PLASMA STABILITY THEORY
A. SIMON, Univ. of Rochester, School of Engin. & Appl. Sci., *Rochester, New York* 14627 (EY-76-S-02-3497)

Nonlinear saturation limits will be calculated for the drift cyclotron loss cone and for the shear-stabilized collisionless drift instabilities. The effects of tearing of field lines caused by drift instabilities, of trapped electrons and of coupling of rational surfaces will be calculated in Tokamak geometry.

RESULTS: A general theory of threshold nonlinear saturation, including collisionless plasma. Application of this method to 8 plasma instabilities and comparison with experiments. Detailed linear treatment of finite-beta resonant-electron and collisional effects on the drift and trapped-electron instabilities in seared magnetic fields. A total of 18 journal articles and 7 Ph.D. theses.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Magnetic Fusion Energy

8.0020, LABORATORY SPECTROSCOPY AT ULTRALONG PATHLENGTHS
B.L. LUTZ, State University of New York, School of Arts & Sciences, *Stony Brook, New York* 11790 (NCA 2-760801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0021, STUDY OF THE INTERACTIONS BETWEEN ELEMENTARY PARTICLES AND NUCLEI
W.D. WALKER, Duke University, Graduate School, *Durham, North Carolina* 27706 (EY-76-S-05-3065)

We are continuing our work on the study of pion production in pion-nucleus collisions. This work includes a continuation of the study of diffraction dissociation. We should complete our studies of direct electron production in pion-p collisions. This work is very promising in that a good determination of the ratio of single electron to pair production should emerge. We are in the process of starting an experiment using the blocks of PB-glass obtained on loan from a SLAC-LBL group. The purpose of this experiment will be primarily to study the formation of resonant mesonic states.

RESULTS: We have improved the information available about neutral particle production from pion plus p interactions at intermediate energies. We have determined the pion zero inclusive production properties in some detail and found neon zero production is suppressed to an unexpectedly low level. These same studies indicate the presence of directly produced photons. We have found some evidence that the known neutral particles may not account for all the energy of the neutral spectrum. Our pion-neon studies have produced interesting results on pion production from nuclei. We have determined the ratio of e/pion production in 18 GeV pion plus or minus p collisions. A very low level of single electron production sets a low limit on the charmed meson production in hadronic collisions.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of High Energy & Nuclear Physics

8.0022, ELECTRONIC STRUCTURES OF DEFECTS IN OXIDES
G.P. SUMMERS, Okla. St. Univ., School of Arts & Sciences, *Stillwater, Oklahoma* 74075 (EY-76-S-05-4837)

The object of the proposed research is to determine the production and trapping of electric charge within the oxides alpha-Al2O3, CaO, SrO, ZnO and spinel, which can be excited by

light (photoconductivity) both before and after irradiation of the materials by gamma-rays, high-energy electrons, protons, or neutrons. The purpose is to detemine as well as possible the electronic structure of defects produced in the materials as a result of the irradiation. In particular we are concerned with radiation-induced anion vacancies in these materials. Additional information will be obtained by measuring photoluminescence and fluorescence lifetimes associated with the radiation-induced defects. The measurements are composed closely with recent calculations of the electronic structure of the defects. We are also concerned with determining the role played by ion group impurities in controlling charge transfer in alpha-Al2O3. Also, we compare results of radiation-induced defects with those produced in non-stoichiometric oxides, in particular CaO.

RESULTS: Photoconductivity has been detected from radiation-induced anion vacancies in SrO of CaO. The thermal activation energy for the one electron center is 0.12 eV and 0.24 eV in SrO and CaO, respectively. In SrO the charge is released into the conduction band or fluorescence occurs from a long-lived electronic state (approximately 0.42 microseconds). Photoconductivity measurements indicate that a radiation-induced optical band at 204 nm in alpha-Al2O3 is a composite band.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Basic Energy Sciences

8.0023, THEORETICAL INVESTIGATIONS INTO THE SCATTERING OF LIGHT BY REAL AEROSOLS
C.R. ACQUISTA, Drexel University, Graduate School, *Philadelphia, Pennsylvania* 19140 (NSG 6019)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0024, STATISTICAL MECHANICS AND THEORY OF SOLIDS
H.B. CALLEN, Univ. of Pennsylvania, School of Arts & Sciences, *Philadelphia, Pennsylvania* 19104 (DMR76-21703 A01)

Research on the statistical mechanical properties of condensed matter carried out under NSF grant DMR72-03146 will be continued. Common to several aspects of this program is the use of renormalization-group techniques in phenomena other than thermodynamic phase transitions. In particular, such techniques will be used for studies of percolation, the theory of random systems, and the problem of turbulence. The latter, and the study of systems far from thermodynamic equilibrium, represent new areas of interest to be pursued during this grant period.

Further investigations using the renormalization group on the various liquid crystal phase transitions, and on phase transitions of surfaces will be carried out.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0025, MAPPING OF ELECTRICAL POTENTIAL DISTRIBUTIONS WITH CHARGED PARTICLE BEAMS
J.W. ROBINSON, Penn. State University, School of Engineering, *University Park, Pennsylvania* 16802 (NSG 3166)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0026, EXPERIMENTAL NUCLEAR STRUCTURE RESEARCH
J.H. HAMILTON, Vanderbilt University, School of Arts & Sciences, *Nashville, Tennessee* 37232 (EY-76-S-05-5034)

Search for the new isotope 182Tl to see if 182Hg is deformed in its ground state and test different predictions based on our knowledge of shape coexistence in this region. The lifetime of the O ion excited shape isomer in 186Hg will be made to test theoretical calculations. Studies of the odd-odd Au isotopes will be begun to test new calculations in this region. Feasibility studies of heavy ion induced fission of Z less than 80 nuclei are planned to prepare for studies of neutron-rich nuclei far from stability at UNISOR with new Tandem accelerator at the Holifield Lab. In-beam spectroscopy of nuclei in the A equals 66-80 region will be continued. Search to confirm our evidence for an anomalous O ion state in 70Se will be done with our first in-beam electron studies. The 76-80 Kr nuclei provide another interesting region to test shape coexistence. Coulomb excitation studies of the even-even Nd and Hg isotopes will be carried out at the ORNL tandem to extend our knowledge of precise E2 and E4 moments beyond the region of well-deformed nuclei. Coulomb excitation of high spin states in the yrast cascades at Super HILAC. Nucleon transfer reaction studies of the 'lambda equals 1' anomalies will be made with 13,12C, 16O and 28Si. Also to be studied are 176,177Hf(9Be, 9Be) and 176Hf(9Be, 10Be) 177Hf at Berkeley.

RESULTS: Evidence for both the g9/2 proton and neutron orbitals was found in 68Ge. These orbitals are found to be important in several nuclei in this region. In 65Ga and 70Se we found the first evidence for asymmetric deformation in this region. Microscopic calculations were carried out in a parameter-free approach for a wide range of nuclei from 24Mg to 168Er. Of particular importance, the systematic behavior of the anomalous O ion states in 70,72 Ge was reproduced in terms of these states being more well deformed than the ground state. We found the first evidence for high K isomeric trapping in a yrast cascade in 178Hf. Coulomb nuclear studies of 180Hf revealed a large E4 matrix element that suggests that a rotational model interpretation of these data is not correct here.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of High Energy & Nuclear Physics

8.0027, ATOMIC AND MOLECULAR PHYSICS
C.B. COLLINS, Univ. of Texas, Graduate School, *Dallas, Texas* 75230 (INT76-18982)

To date, this project has introduced the concept of hybrid resonances in multiphoton spectroscopy, demonstrated a technique suited for the examination of diffuse molecular bands, and pointed a direction toward discovery, identification and analysis of repulsive and weakly bound states of alkali molecules. In the forthcoming period, work will be directed to quantitative studies significant to broad areas of plasma chemistry, laser physics, and aeronomy, and specifically to applied physics efforts in e-beam lasers and photochemistry. Structure and properties of repulsive states of alkali-bearing molecules will be defined, primarily by multiphoton spectroscopy. The order of occurrence of repulsive states of cesium, not expected in earlier theory, will be further delineated by examination of the dissociative part of the cesium spectrum. The work will be extended to rubidium, and subsequently applied to cesium and rubidium combinations with inert gases in order to obtain comprehensive spectroscopic data on the excimer states of these alkali-inert gas molecules. Finally, collisional effects will be studied by variation of the time delay between laser excitation of molecular transition and laser detection of the dissociation fragments.

This work will be conducted in cooperation with Iovitzu Popescu, et al., Institute of Physics, Bucharest, Romania. Experimental work on cesium will produce quantitative values of line strengths and potential curves for comparison with developing theory. The evolving theory itself is mainly a Romanian contribution, and will be numerically evaluated on U.S. computers. Application will then be directed to fine structure effects and subsequently extended to additional alkali systems.

SUPPORTED BY U.S. National Science Foundation, Div. of International Programs

8.0028, RETARDING POTENTIAL ANALYZER FOR THE DYNAMIC EXPLORER
W.B. HANSON, Univ. of Texas, Graduate School, *Dallas, Texas* 75230 (NAS 5-24298)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0029, ION DRIFT METER FOR THE DYNAMIC EXPLORER
R.A. HEELIS, Univ. of Texas, Graduate School, *Dallas, Texas* 75230 (NAS 5-24297)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0030, INVESTIGATION OF ELECTRIC FIELDS IN THE VICINITY OF PLASMAPAUSE MID-LATITUDE TROUGH AND POLAR CLEFT
J.C. FOSTER, Utah Higher Education System, Graduate School, *Logan, Utah* 84321 (NSG 5216)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0031, STUDIES OF HIGH-LATITUDE ION DYNAMICS
J.P. ST. MAURICE, Utah Higher Education System, Graduate School, *Logan, Utah* 84321 (NSG 5215)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0032, A MAGNETIC RESONANCE STUDY OF BASIC DEFECTS IN RUTILE
W.D. OHLSEN, Utah Higher Education System, School of Letters & Science, *Salt Lake City, Utah* 84112 (DMR74-17545 A01)
Continuation of research supported under DMR 74-17545.

The research will be concerned with an investigation of the defect structure of rutile crystals. Experiments will be carried out using magnetic resonance techniques. These will provide a microscopic view of defects on the atomic level. Among the defects to be studied are oxygen vacancies, titanium interstitials and impurities of hydrogen, niobium, tantalum, aluminium and bismuth. A new method for growing improved crystals of rutile will be pursued.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0033, LONG-TERM TEMPERATURE EFFECTS ON GALLIUM ARSENITE SOLAR CELLS
J.H. HEINBOCKEL, Old Dominion University, School of Engineering, *Norfolk, Virginia* 23508 (NSG 1465)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0034, GAMMA-RAY AND X-RAY SPECTROSCOPY OF SOLIDS UNDER PRESSURE
R.L. INGALLS, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (DMR76-21053)

Research will be carried out to investigate the structure and behavior of materials at high pressures. Mossbauer effect (recoilless gamma-ray resonance) experiments in magnetic materials will be used to study the magnetic phases and critical phenomena near tricritical points and phase boundaries at various temperature and pressures. Extended X-ray absorption fine structure (EXAFS) experiments will be done in order to study the electronic and structural changes in materials using synchrotron radiation.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, PHOTOELECTRIC PHOTOMETRY OF YOUNG CLASSICAL CEPHEIDS
G.V. COYNE, Univ. of Arizona, School of Liberal Arts, *Tucson, Arizona* 85721 (AST77-12920)

The knowledge of the spiral structure of our galaxy relies very much upon the location of the youngest stars in the galaxy. Young stars and Cepheid variable stars are important for determining distances. From a knowledge of their period of light variation and their color, one can determine their intrinsic brightness and therefore their distance.

Observation of twenty such Cepheids, all of which have relatively long periods and are, therefore, young, will be carried out. The stars are faint and thus at large distances.

It has been determined that seventy percent of these stars are at distances greater than 4 kpc, about 40 percent of the distance of the sun from the center of the galaxy. Several of them may indicate the presence of spiral arms or, at least, fragments of spiral arms previously unknown. The possible extension towards the galactic anticenter of a spiral arm at about 6 kpc from the sun has already been indicated by observations.

A continuation of observations will be carried out to determine securely the location of all of the faint long-period Cepheids under investigation.

This research was previously supported under grant MPS 73-04395.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0002, ANALYSIS OF MOLECULAR SPECTRA
S.P. DAVIS, Univ. of California, School of Letters & Science, *Berkeley, California* 94720 (AST76-05905 A01)

The successful study of molecular structure, excitations and abundances in astrophysical sources requires extensive and reliable laboratory information on molecules. This information includes transition identifications, relative and absolute transition probabilities and dissociation energies. This research program will provide astrophysicists with such information. During the coming year, the analysis of ZrO will be completed. The infrared spectrum of TiO and the spectra of FeH and FeD will be studied. A program to measure the lifetimes of excited molecular states will be carried out. Computer generated synthetic spectra of ZrO will be compared with electronic furnace spectrograms and photoelectric scans. The laboratory measure, analyses and transition probabilities will be applied to studies of molecular spectra found in cool stars.

This action provides additional funding for work previously supported by NSF grant AST76-05905 for 12 months duration.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0003, EXCITATION OF INTERSTELLAR H20 MASERS VIA THE COLLISION OF PROTOSTELLAR FRAGMENTS AND OBSERVATIONS OF INTERSTELLAR OH MASERS (ABBREV)
J.I. SILK, Univ. of California, School of Letters & Science, *Berkeley, California* 94720 (NCA 2-50711)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0004, RESEARCH INTO THE THEORY OF STELLAR STRUCTURE AND EVOLUTION
R.K. ULRICH, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (AST76-20260 A01)

This grant will provide support for research in the structure and evolution of stars. Stars in unusual stages of evolution will be the subject of this research. In particular, work will be carried out on the birth of stars similar to the sun and on interacting binary systems.

There will be detailed spectroscopic studies of the T Tauri stars. It has usually been assumed that these stars are ejecting matter from their surfaces. Theoretical models will be computed to determine if the spectral properties can be caused by matter

still falling onto the surface of the star. If this is the case, one will be able to deduce by direct observation the processes which occur in the late stages of star formation.

The dwarf novae stars will be studied. These systems are known to contain gaseous disks which surround a compact star. The systems which will be studied are weak X-ray sources, and the light emitted from the disk dominates the light from the system. Thus, the properties of the disk can be determined by direct observation. Studies will also be carried out on oscillations in the sun.

This research is a continuation of work previously supported by NSF grant AST76-20260.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0005, RELATIVISTIC ASTROPHYSICS
J.E. GUNN, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (AST76-80801 A01)

This proposal covers research in many different areas of astrophysics and relativity. The research will be primarily theoretical, but will also include some astronomical observations and some aspects of experimental relativity. The topics to be studied include: (a) the large-scale structure and cosmological evolution of the universe; (b) the origin, structure, and evolution of galaxies and clusters of galaxies; (c) the dynamics of globular clusters and the distribution of masses for the oldest stars in the universe; (d) late stages of stellar evolution and the structures of giant stars that have neutron stars or black holes in their cores; (e) close binary star systems and their roles as compact X-ray sources; (f) gravitational collapse and black holes; (g) the theory of the generation of gravitational waves and plans for a search for gravitational waves using Doppler tracking of interplanetary spacecraft; (h) design studies for new experiments to test general relativity theory.

This work is a continuation of work previously supported by NSF grant AST76--80801.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0006, ASTRONOMY RESEARCH AT THE OWENS VALLEY RADIO OBSERVATORY
A.T. MOFFET, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (AST77-00247 A01)

Extragalactic research will center on the fine-scale radio properties of quasars and nuclei of active galaxies, the continued study of the polarization and intensity changes in variable sources, and the kinematics and gas content of nearby galaxies. Galactic research will include studies on isotope abundances in various parts of the galaxy, the fine structure of the non-thermal source at the galactic center and the physical properties of dense clouds and associated interstellar masers.

In the solar system, work will continue on the scattering properties of the rings of Saturn, the shape of the Jovian radiation belts and the thermal properties of the major satellites. A new interference polarimeter will be used to examine the small-scale structure of solar flares at centimeter wavelengths. A prototype 10-meter millimeter-wave telescope will be outfitted with receivers and used for observations of interstellar CO and other molecules. Installation of electronics and control systems for a three-element millimeter-wave interferometer will also be initiated.

This research is a continuation of work previously supported under NSF Grant AST 77-00247.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0007, OBSERVATIONAL PROGRAM IN GROUND-BASED INFRARED ASTRONOMY
G. NEUGEBAUER, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (AST77-20516)

An infrared astronomy program using the telescopes of the Hale Observatories will be carried out. The program emphasizes the unique capabilities of the 200 inch telescope--high spatial resolution with high signal-to-noise--combined with high-sensitivity photometric equipment developed over the past years. Highest priority will be put on high spatial resolution studies of galactic nuclei and point sources using the 200 inch; this can determine size structure with an uncertainty of approximately 0.1". An increasing emphasis is being placed on high spatial resolution, medium spectral resolution spectroscopy. The telescopes at Las Campanas, Chile, and Mauna Kea, Hawaii, will also be used.

The specific scientific programs which will be emphasized include the continuation of the study of molecular hydrogen with high spatial resolution. The systematic study of the infrared energy distributions of quasars will be continued along with low-resolution spectroscopy to identify atomic lines which are redshifted into the near infrared in comparison with lines which are redshifted into the visible. Several extragalactic and galactic ionized hydrogen (H II) regions will be studied in addition to the observations of regions of star formation within the Galaxy.

This is a continuation of research begun under NSF grant AST 74-18555 A2.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0008, PROBLEMS OF BINARY STAR EVOLUTION - INSTABILITIES AND UNSTEADY STATES
J. FAULKNER, Univ. of California, Graduate School, *Santa Cruz, California* 95060 (AST75-09751 A01)

Studies will be carried out on the exchange of mass and energy between the members of close binary stellar systems. The particular emphasis of these studies will be an examination of the instabilities and unsteady states occurring during such mass exchanges. There will be a treatment of instabilities taking place beneath the surface of the star which is transferring mass to its companion. This will be done in order to determine whether the timescales of such instabilities are responsible for the repetitive nature of the outbursts seen from these systems. It is also possible that such sub-surface instabilities modulate some more fundamental mechanism which is causing the repeated outbursts. The techniques will be applied to a variety of models, and an attempt will be made to obtain predictions on the behavior of observational properties of these systems. The dynamic behavior of a neutron star as it enters the central region of a supergiant star with which it shares a common envelope will be studied. Such an evolution may be a step in producing a binary pulsar. This is a renewal of work previously supported by NSF Grant AST 75-09751.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0009, PHOTODISSOCIATIVE EXCITATION DETECTION OF PARENT MOLECULES IN COMETS
W.M. JACKSON, Howard University, School of Liberal Arts, *Washington, District of Columbia* 20001 (NSG 7378)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0010, PHOSPHORUS IN COARSE-STRUCTURED IRON METEORITES
R.S. CLARKE, Smithsonian Institution, *Washington, District of Columbia* 20560 (3370-49)

The relationship of phosphide precipitation to the development of the Widmanstatten pattern in coarse-structured iron meteorites is under study. The distribution of nickel and phosphorus within schreibersite and kamacite and taenite is being used as a tool in study of the cooling history of these meteorites.

SUPPORTED BY Smithsonian Institution, Museum of Natural History

10.0011, INVESTIGATIONS OF THE COMPOSITION OF MATRICES IN VARIOUS CHONDRITIC METEORITES
K. FREDRIKSSON, Smithsonian Institution, *Washington, District of Columbia* 20560

We propose to separate chondrules, lithic and mineral fragments from the fine-grained matrix which appear to be akin to carbonaceous chondrites in chemical composition and thus may represent a 'primitive' condensate in the solar nebula. The distribution of some critical elements (e.g., heavy volatiles and rare gasses) between these fractions will be determined in order to test the hypothesis.

SUPPORTED BY Smithsonian Institution, Museum of Natural History

10.0012, CHEMICAL INVESTIGATION OF METEORITES
E. JAROSEWICH, Smithsonian Institution, *Washington, District of Columbia* 20560 (6500-30)

Currently, the chemical investigation of stony meteorites is in progress. This work encompasses the chemical analysis of acid-soluble and acid-insoluble phases of meteorites for major and minor constituents. Also, the analysis of meteoritic separates is performed. The analysis of meteorites is a part of a broader study of mineralogy, petrology and classification of meteorites.

SUPPORTED BY Smithsonian Institution, Museum of Natural History

10.0013, RESEARCH ON DYNAMICAL PHASES OF STELLAR EVOLUTION
J.R. BUCHLER, State University of Fla. Sys., School of Arts & Sciences, *Gainesville, Florida* 32601 (AST77-17572)

Three phases of stellar evolution will be examined: 1. There will be studies of supernova models attention devoted to problems of neutrino transport in the stellar material. These studies will examine the problem of ejection of the envelope of a star during the supernova explosion. 2. There is both observational and theoretical evidence that stars in the mass range of four to eight solar masses are stars which become supernovae. It is believed that thermonuclear ignition of carbon in the cores of these stars gives rise to supernova events and pulsar remnants. Hydrodynamic studies of such stars will be made. 3. New numerical and analytical techniques will be developed to treat the problem of the evolution of a star which is oscillating. These techniques will be applied to studies of the Cepheid variables, massive hydrogen burning stars, the stars which are still in the process of formation.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0014, FAR INFRARED AND SUBMILLIMETER ASTRONOMY WITH THE LEAR JET OBSERVATORY
R.H. HILDEBRAND, Univ. of Chicago, School of Physical Sciences, *Chicago, Illinois* 60637 (NSG 2261)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0015, THE TERMINAL STAGES OF STELLAR EVOLUTION IN THE MODERN THEORY OF THE STRONG FORCE
M.B. KISLINGER, Univ. of Chicago, School of Physical Sciences, *Chicago, Illinois* 60637 (PHY77-16190)

Two terminal stages of stellar evolution, neutron stars and supernovae, will be studied. Previous work has helped to formulate the formalism of relativistic many-body theory through the proof of two important theorems. The application of these theorems to the modern theory of the strong force, the non-abelian gauge theory of quarks and gluons, (Quantum Chromodynamics, QCD) resulted in the proof that the strong force becomes weak at high densities and amenable to perturbation theory. There will be continued application of QCD to stellar evolution and to obtain the dynamic properties of stellar collapse (at high densities) and neutron stars, as opposed to the previously completed static properties. Previous work on the equation of state for dense stellar matter will be extended to non-zero temperatures as appropriate for studying dynamic properties of dense stellar matter. An attempt will then be made to calculate: 1. The neutrino capacity for high densities. (Elastic scattering dominates the opacity and is calculable to high accuracy using perturbation theory for rho greater than 4 x 10 to the 14th power gm/cc.) 2. Neutron star luminosities. (The cooling of neutron star cores is done by nu, nu bremsstrahlung and the URCA process involving strongly interacting particles. This is calculable using perturbation theory.) 3. Investigation of the characteristics of the hydrodynamic bounce and supernova generated by the QCD equation of state for matter undergoing gravitational collapse. 4. The influence of hyperonic matter at high densities. (The creation of hyperonic matter at high densities (it appears at 7.35 x 10 to the 14th power gm/cc in stable neutron stars) releases an enormous amount of energy which can be calculated using QCD.)

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

10.0016, RESEARCH IN NUCLEAR ASTROPHYSICS
J.W. TRURAN, Univ. of Illinois, School of Liberal Arts & Sci., *Urbana, Illinois* 61801 (AST76-22673 A01)

Research to be carried out on this grant will be primarily concerned with two broad topics in nuclear astrophysics: (1) the mechanisms by which heavy nuclei are formed in stellar interiors, novae, and supernovae, and (2) the consequences of mass accretion onto white dwarfs in aging binary systems. Detailed calculations have shown that the composition of matter ejected in nova and supernova explosions is consistent with accurately determined abundances characteristic of solar system material. Specific studies to be undertaken include the following: (1) Hydrodynamic studies will be made of the conditions which give rise to thermonuclear runaways in the hydrogen envelopes of white dwarf stars. (2) There will be studies of nova light curves. (3) Studies will be made of the consequences of mass accretion onto white dwarf stars and neutron stars. (4) An examination will be made of the effects of accretion of interstellar material onto isolated white dwarf stars in the disk of our galaxy. (5) There will be studies of nucleosynthesis in massive stars and red giant stars. (6) There will be studies of the properties of nuclear matter as well as studies of dust grain formation and growth in novae and supernovae.

This research is a continuation of research previously supported under NSF grant AST76 22673.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0017, THEORETICAL INVESTIGATIONS OF THE STRUCTURE OF LOW-TEMPERATURE STELLAR ATMOSPHERES AND THE STRUCTURE AND EVOLUTION OF THE OUTER PLANETS
A.S. GROSSMAN, Iowa State Univ. of Sc. & Tech, School of Hum. & Sciences, *Ames, Iowa* 50010 (NCA 2-340801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0018, INTERNATIONAL SUN-EARTH EXPLORER-A EXPERIMENT DATA REDUCTION AND ANALYSIS
D.A. GURNETT, Univ. of Iowa, School of Liberal Arts, *Iowa City, Iowa* 52240 (NAS 5-24336)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0019, PARTICLES AND CURRENTS IN THE GEOMAGNETIC FIELD
D.B. BEARD, Univ. of Kansas, School of Liberal Arts & Sci., *Lawrence, Kansas* 66045 (ATM76-23448 A01)

This grant continues the development of a self-consistent theory of the earth's magnetotail. The investigators will complete the calculation of the magnetic field throughout the tail from integrating over all currents in a self-consistent way (The currents are derived from the successive approximations of the magnetic field). Secondly, they will examine the entrance of plasma into the tail from the magnetosheath as a result of particle drift. In ad-

dition satellite data will be analyzed for plasma near the magnetopause and compared with the theoretical results. Thirdly, they will extend the magnetotail calculations towards the earth expecting to derive the abrupt near-earth edge of the magnetotail current system where the earth's dipole field inhibits the tail sheet current. The overall aim of this work is to further our understanding of the magnetic field of the earth and the way in which solar particles penetrate that field.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0020, ANOMALOUS ABUNDANCES IN THE SUBGIANT CH STARS
H.E. BOND, Louisiana State Univ. Systems, School of Chemistry & Physics, *Baton Rouge, Louisiana* 70803 (AST76-11567 A01)

A joint observational and theoretical study of the subject of the subgiant CH stars will be undertaken. This recently identified class of peculiar field stars consists of G-type stars with enhanced abundances of carbon and other elements. Their low luminosities are in contradiction with theoretical studies, which indicate that the mixing of the stellar materials necessary for the appearance of these elements at the surface occurs only in stars of considerably higher luminosity.

A program of high-dispersion spectroscopy of these stars is planned in order to carry out abundance analyses. A search for new CH stars will be made in globular clusters, and among field stars, to better establish their luminosities, and provide estimates of the stellar lifetime in this phase. The observational results will be compared with theoretical evolutionary calculations for low-mass stars under a variety of mixing events.

This research represents a continuation of work previously supported under NSF Grant AST76-11567.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0021, FLARES ON DEGENERATE STARS
G. CHANMUGAM, Louisiana State Univ. Systems, School of Chemistry & Physics, *Baton Rouge, Louisiana* 70803 (AST76-06807)

A number of rapid transient phenomena have recently been observed at X-ray and gamma-ray wavelengths. It has been hypothesized that these phenomena are due to sudden outbursts on the surface of white dwarf and neutron stars. The study of flares on such stars will require an examination of (a) the magnetohydrodynamic instabilities in degenerate matter in the presence of strong magnetic fields; (b) the development of the instabilities leading to the flare outburst; and (c) a study of the radiation mechanisms for the flares.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0022, RESEARCH STUDY OF DETERMINATION OF PARTICLE SIZE IN CLOUDS
R.L. SCOTT, Southern Univ. A & M College, School of Engineering, *Baton Rouge, Louisiana* 70813 (NSG 8056)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0023, A STUDY OF THE FEASIBILITY OF ULTRAVIOLET SPECTROMETRY FOR COMETARY MISSIONS
P.D. FELDMAN, Johns Hopkins University, School of Arts & Sciences, *Baltimore, Maryland* 21218 (NSG 7382)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0024, PHYSICS STUDY OF PLANETARY NEBULAE
D.G. CURRIE, Univ. of Maryland, School of Engineering, *College Park, Maryland* 20740 (NCA 5-24)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0025, STUDIES OF MAGNETIC PECULIAR A STARS
S.J. ADELMAN, Boston University, School of Arts & Sciences, *Boston, Massachusetts* 02215 (AST76-06233 A01)

This research will be concerned with observational and theoretical studies of the sharp-lined magnetic Ap stars. These stars are known to have large surface magnetic fields and peculiar chemical abundances. Spectroscopic and spectrophotometric observations of these stars will be used for line identifications and abundance analysis studies. A study will be made of how magnetic fields in these stars affect the observed properties of the stars. Models of chemically inhomogenous atmospheres will be computed and the observational predictions of such models will be compared with actual observations. The evolution of an Ap star will be computed in order to determine the physical parameters that affect the atmospheres of these stars.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0026, FAR INFRARED OBSERVATIONS OF OPTICAL REGIONS
E.L. WRIGHT, Mass. Inst. of Technology, Graduate School, *Cambridge, Massachusetts* 02139 (NSG 2263)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0027, STELLAR PHYSICS - ANALYSIS OF SOLAR ROCKET AND SATELLITE DATA
E.H. AVRETT, Smithsonian Institution, *Cambridge, Massachusetts* 02138

Development of numerical methods for the solution of the equations of statistical equilibrium and the equation of radiative transfer in spectral lines and in continua. Application of the numerical methods to solar and stellar lines of multilevel atoms, especially in study of the chromospheric structure of the sun. Investigation of the properties of radiation emerging from stochastic media, and media exhibiting horizontal structure. Study of deviations from local thermodynamic equilibrium in stellar photospheres. Determination of the source function from observations of solar lines by means of an inversion of the Laplace transform. Development of methods for correcting observed spectral profiles for instrumental broadening and noise.

Also, studies of observational data, namely ultraviolet spectra of the sun, to be used to test and improve SAO models of the variation with optical depth of structure, density, and pressure in quiet regions of the sun. The improved models will then be used to extend this analysis to active regions.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0028, ECHELLE SPECTROMETER MEASUREMENTS ON THE INTERSTELLAR MEDIUM
F.H. CHAFFEE, Smithsonian Institution, *Cambridge, Massachusetts* 02138 (310-4050-04)

Atomic and molecular absorption lines of many species have been detected in the spectra of several stars in the Perseus region. The measured abundances provide an appreciable body of new data that allows detailed comparison with theoretical predictions. Certain broad aspects of the current theory of molecular abundances are confirmed, but the theory is shown not to explain the details of abundances.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0029, FLIGHT EXPERIMENTS - GAMMA-RAY BALLOON EXPERIMENT
G.G. FAZIO, Smithsonian Institution, *Cambridge, Massachusetts* 02138

To study the emission of gamma radiation from celestial sources, a new type of detector, the gas-Cerenkov telescope, has been developed. Two versions of this detector, one in the 10-100 MeV region, the other in the region above 150 MeV (in conjunction with Cornell University), have been constructed and flown in high-altitude balloons to search for gamma rays from cosmic sources.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0030, MEASUREMENT OF TRITIUM AND ARGON IN RETURNED LUNAR MATERIALS (ISOTOPIC STUDIES)
E.L. FIREMAN, Smithsonian Institution, *Cambridge, Massachusetts* 02138 (NGR 09-015-145)

OBJECTIVES: 1) Measure Ar37, Ar39, and H3 as a function of depth in the deep core of a large documented rock from Apollo 17. 2) Continue to measure the Ar39 and H3 in two large documented rocks of different chemical compositions from either Apollo 17 or previous Apollo missions. 3) Also measure Ar39 production cross sections in thick Ti, Ca, and K targets bombarded with protons of energies between 50 and 600 Mev. 4) Measure H3 in four quadrants of oriented aluminum tube G3 from Surveyor 3. Determine ages and histories of meteorites by means of isotope measurements.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0031, SOLAR SYSTEM DYNAMICS
F. FRANKLIN, Smithsonian Institution, *Cambridge, Massachusetts* 02138 (31P-4P50-09)

With the aid of computer simulation of the solar system, and using traditional analytical methods of celestial mechanics, the evolution of the system of asteroids is studied. The hypothesis under test is that the asteroids were initially distributed uniformly from Mars to Saturn and beyond, and that the present distribution, which is confined to a relatively narrow belt between Mars and Jupiter, is the remnant of a much more extensive configuration. The bulk of the asteroids are hypothesized to have been removed by planetary perturbations, by physical collisions, and by aerodynamic drag of gas in the primeval solar nebulae. We are also beginning a search for isolating integrals of the elliptic restricted three body problem (using the method of surfaces of section) as another and powerful method of checking this hypothesis.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0032, CALCULATING A LINE-BLANKETED MODEL ATMOSPHERE FOR THE SUN
R. KURUCZ, Smithsonian Institution, *Cambridge, Massachusetts* 02138 (31S-4S50-03)

It is possible to formulate mathematical models of a star such as the sun that agree very closely with observations in the visible and infrared. However, when the models' predictions are extended into the ultraviolet there are large discrepancies because the models do not include the thousands of absorption lines that fill this wavelength region. This is known as the missing ultraviolet opacity problem.

Kurucz and Avrett have calculated the statistical representation for the line opacity with new data on over 1,000,000 lines and have computed an improved model for the sun to demonstrate that the missing ultraviolet opacity problem has indeed been solved. Having found that the method gives good results for the sun, they are applying it to a larger range of stellar problems.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0033, COMETS
B. MARSDEN, Smithsonian Institution, *Cambridge, Massachusetts* 02138 (31P-4P50-07)

Work is being continued on several aspects of orbital problems on comets and minor planets. In particular, our studies pertain to the examination of the non-gravitational forces acting on comets and to the behavior of objects in orbit close to the 2:1 mean-motion resonance with Jupiter.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0034, STUDY OF AFRICAN RIFT SYSTEM FROM ERTS SATELLITE
P.A. MOHR, Smithsonian Institution, *Cambridge, Massachusetts* 02138 (NAS-5-21748)

Mapping major structures of the African rift system from ERTS-1 imagery at a scale of 1:1 million. The latitude limits of this mapping are 20 degrees S and 20 degrees N. The structures mapped include Precambrian metamorphic strike, Cainozoic faults, lineaments, volcanic edifices and craters, as well as lithological boundaries. A composite 1:5 million map has been produced.

The final report is nearing completion and will be published in July 1974.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0035, A TWO-FREQUENCY VLBI EXPERIMENT
J.M. MORAN, Smithsonian Institution, *Cambridge, Massachusetts* 02138

Very long baseline interferometry experiments were conducted to determine the spatial structure of molecular line emission from galactic radio sources. Some funds were diverted to the Spectral Lines project for purchase of equipment.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0036, RADIATIVE TRANSFER - GRAVITATIONAL DYNAMICS
G. RYBICKI, Smithsonian Institution, *Cambridge, Massachusetts* 02138 (31T-4T50-05,06)

Work in radiative transfer theory has been in the area of resonance line transfer, transfer in multilevel atoms, spherical media and media with inhomogeneities. There has been particular involvement with basic methodology of these problems, especially in those adaptable to digital computation. Recent work on the newly discovered Q integral of the equation of transfer has been extended to another integral, called the P integral.

Collaborations with P. Noerdlinger on radiative transfer in rapidly expanding clouds (Astrophys. Journ., in press), has been completed as well as continuing joint efforts with P.G. Martin on radiative transfer through circumstellar dust shells. This latter work should aid understanding of the infrared spectrum of such objects.

In the field of gravitational dynamics Dr. Rybicki has worked on the statistical mechanics of gravitating systems and on methods of simulating galactic dynamics. He has completed experiments with Mr. G. Zimmermann on a new method of simulating solutions to the linearized Vlasov equation, the method of perturbation particles. Also, with Dr. Lecar and Miss M. Schaefer he has developed a method of relating surface mass densities of flattened systems, such as spiral galaxies, to the law of force in the plane of these systems. This method is also being applied to the inverse problem of finding surface mass densities from observed rotation curves of spiral galaxies.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0037, DYNAMICAL AND PHOTOMETRIC INVESTIGATION OF COMETARY II TAILS
Z. SEKANINA, Smithsonian Institution, *Cambridge, Massachusetts* 02138 (NGR 09-015-159; 163490-31P)

Collect suitable observational material and subject them to critical evaluation. Examine techniques for obtaining isophotometry and translation of the Finson-Probstein computer program into existing computer language.

Continue photometry on suitable comet plates. Establish first-approximation hypotheses for the space-density, particle-size and initial-velocity distributions.

Refine distribution functions of the models to obtain best agreement between measured and computed isophotos.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0038, OPTICAL SPECTROSCOPY OF THE INTERSTELLAR MEDIUM

W.A. TRAUB, Smithsonian Institution, *Cambridge, Massachusetts* 02138 (310-4050-12)

A spectroscopic search was made for a deuterium emission line in the Orion nebula in order to determine the isotope ratio of deuterium to hydrogen, which is a crucial parameter in cosmological models of the formation of the universe. From our observations, we are able to set an upper limit D/H less than 1.3 x 10 to the minus 4th power; from our earlier detection of deuterium on Jupiter, we expect that a factor of 10 further improvement will be needed for a measurement in Orion. The presence of a previously undetected high-velocity cloud with an H alpha emission feature which partially overlaps the expected D alpha position is the only impediment to a more accurate determination.

Analysis of our earlier observations of the CN absorption band a 3874 A was completed, resulting in a determination of the cosmic background radiation temperature (at 1.32 mm) of about 2.9 degrees K.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0039, THEORETICAL STUDIES OF SOLAR WIND DYNAMICS

S.F. NERNEY, New Hampshire College, Graduate School, *Manchester, New Hampshire* 03104 (NCA 2-509701)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0040, A NUMERICAL ANALYSIS OF GROUPS OF GALAXIES

J.R. GOTT, Princeton University, Graduate School, *Princeton, New Jersey* 08540 (AST76-24481)

A study of the dynamics of groups of galaxies using numerical N-body simulations will be carried out. The results will be compared with observational data. A catalog of groups of galaxies was recently constructed using data from the Zwicky catalog of clusters of galaxies. A number of numerical simulations of galaxy clustering using 1000 point masses was prepared in collaboration with Dr. S. Aarseth in England. The models of the groups of galaxies will be analyzed in the same way as with observed galaxies. The analysis should give information on the masses of galaxies, how groups and clusters of galaxies form, and the initial mass density fluctuation spectrum in the universe. A clearer test of whether the universe is closed or open should result. The research will be done in collaboration with Dr. E. Turner at Harvard College Observatory.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0041, AIRBORNE INFRARED AND SUBMILLIMETER ASTRONOMICAL POLARIZATION MEASUREMENTS AT DIFFERENT WAVELENGTHS

M.O. HARWIT, Cornell University, School of Arts & Sciences, *Ithaca, New York* 14853 (NSG 2262)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0042, INFRARED SPECTROSCOPY OF SIMULATED MARTIAN SURFACE MATERIALS

C. SAGAN, Cornell University, School of Physical Sciences, *Ithaca, New York* 14850 (NSG 2277)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0043, FAR INFRARED OBSERVATIONS OF DARK CLOUDS USING LEAR JET OBSERVATORY

M. SIMON, State University of New York, School of Arts & Sciences, *Stony Brook, New York* 11790 (NSG 2264)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0044, PROGRAM OF 1-5 MICRON PHOTOMETRY OF INFRARED SOURCES EMBEDDED IN MOLECULAR CLOUDS

N.J. EVANS, Univ. of Texas, Graduate School, *Austin, Texas* 78712 (NSG 7381)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0045, ANALYSIS OF ULTRAVIOLET STELLAR SPECTRA OBTAINED WITH SKYLAB EXPERIMENT S-O19

K.G. HEINZE, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (NSG 7371)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0046, RED GIANT STARS

J.M. SCALO, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (AST77-11883)

This research will be concerned with carrying out an extensive comparison of the theoretical and observed properties of red giant stars. The research will consist of: (1) comparison of a theoretical statistical description of the observable properties of red giant stars with observational data concerning masses, spectral types, and luminosities in order to obtain estimates for red giant star lifetimes and mass loss rates; and (2) a similar comparison applied to the theoretical and observed frequency distributions of the strength of lines (in the spectra of these stars) for certain elements. This comparison will serve as a constraint on theories of mixing in red giant stars having peculiar chemical abundances.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0047, IONOSPHERIC MODIFICATION EXPERIMENTS AT ARECIBO

W.E. GORDON, Rice University, Graduate School, *Houston, Texas* 77001 (ATM76-15550)

This grant funds an experimental program at the National Astronomy and Ionosphere Center at Arecibo, Puerto Rico, to artificially heat the ionosphere and observe the resulting effects. Heating is accomplished by transmitting a strong radio beam up into the ionosphere at a carefully selected frequency. Particular phenomena to be studied with this technique include: 1. collisional and radiative damping mechanisms, 2. thermal processes associated with the loss of the energy given to the electrons by the HF waves, and 3. the temperature dependence of the reaction rates associated with the airglow.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0048, ION MOLECULE REACTIONS OF IMPORTANCE IN PLANETARY ATMOSPHERES

R.F. STEBBING, Rice University, Graduate School, *Houston, Texas* 77001 (NSG 7386)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

GENERAL

11.0001, SELECTED TARGET SEARCH FOR EXTRATERRESTRIAL OBSERVATIONS USING VERY LONG BASE INTERFEROMETRY TECHNIQUES AND PATTERN RECOGNITION STUDIES

W.J. WELCH, Univ. of California, School of Engineering, *Berkeley, California* 94720 (NSG 2271)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

11.0002, OPERATION OF THE NASA-AMES UNIVERSITY CONSORTIUM OFFICE

L. EISENBERG, Calif. State Univ. & Colleges, Graduate School, *San Francisco, California* 94132 (NCA 2-660801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

11.0003, HISTORY OF ROCKETS AND SPACE FLIGHT

F.C. DURANT, Smithsonian Institution, *Washington, District of Columbia* 20560

Refinement of chronological history of rockets and space flight; identification of individuals, inventions and events that influenced technological advances. Major effort includes nineteenth century rocket ordinance, lifesaving and whaling rockets, biographical data, military engagements using rockets, and history of pyrotechnics as related to military rockets. Study of development of literature of spaceflight as related to technology of times. Europe, eastern Europe, U.S.S.R. and India are foreign areas involved.

SUPPORTED BY Smithsonian Institution, National Air & Space Museum

11.0004, ROBERT H. GODDARD AND CHARLES A. LINDBERGH

F.C. DURANT, Smithsonian Institution, *Washington, District of Columbia* 20560

Goddard and Lindbergh, two outstanding contributors to rocketry and aviation, had a professional relationship during the years 1929-1940. The proposed study would be a chronicle of their meetings and correspondence and commentary on their strongly individual personalities. Sources of information include 'This High Man' by Milton Lehman (Farrar, Stauss), 'The Papers of Robert H. Goddard' (McGraw-Hill), archives of Charles A. Lindbergh at St. Louis, Missouri, and New Haven, Connecticut, as well as interviews with Mrs. Robert H. Goddard and General Lindbergh. Both Mrs. Goddard and General Lindbergh have indicated interest in this project and resultant paper. Authorization by General Lindbergh of access to his archival papers and photographs is on file.

SUPPORTED BY Smithsonian Institution, National Air & Space Museum

11.0005, U.S. WOMEN FLIERS 1910-1918

C.M. OAKES, Smithsonian Institution, *Washington, District of Columbia* 20560

This will be the first of several monographs on U. S. women fliers. It will be published in the Smithsonian Studies in Air and Space Series.

The manuscript is complete and is being reviewed and edited. It will be submitted for publications in November 1977.

SUPPORTED BY Smithsonian Institution, National Air & Space Museum

11.0006, NOTABLE CONTRIBUTORS TO FLIGHT TECHNOLOGY

H.S. WOLKO, Smithsonian Institution, *Washington. District of Columbia* 20560

The intent of this research is to provide the community of aerospace historians with information relative to notable contributors to flight technology. Many of the individuals who have made major contributions to the technology of flight have attracted little attention, yet their accomplishments are responsible for progress in the field.

Thumbnail biographical sketches of some 130 individuals (selected by committee) will be prepared. Although the sketches are to be non-technical, sources references will be included. A topical format, preceded by a brief overview of progress in the particular topic, has been selected as most appropriate. Individuals will be presented chronologically within each topic.

PROGRESS: 129 of 130 individuals have been researched. A rough draft thumbnail sketch has been prepared. Introductory overviews are in preparation.

SUPPORTED BY Smithsonian Institution, National Air & Space Museum

11.0007, SERVICES FOR OPERATION OF WALLOPS' TECHNICAL LIBRARY

J.C. SMITH, Univ. of Maryland, Undergraduate School, *Princess Anne, Maryland* 21853 (NAS 6-2855)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

11.0008, MICROWAVE REMOTE SENSING SYMPOSIUM WORKSHOP

J.W. ROUSE, Texas A & M University System, School of Engineering, *College Station, Texas* 77843 (NAS 9-15451)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N78-15986* + National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 89, NOVEMBER 1977
Nov. 1977 125 p refs
(NASA-SP-7037(89)) Avail: NTIS HC A06/MF A01 CSCL 01A

This bibliography lists 538 reports, articles, and other documents introduced into the NASA scientific and technical information system in October 1977. Author

N78-15987*# Nielsen Engineering and Research, Inc., Mountain View, Calif.
PERTURBATION SOLUTIONS FOR TRANSONIC FLOW ON THE BLADE-TO-BLADE SURFACE OF COMPRESSOR BLADE ROWS Final Report
Stephen S. Stahara, Denny S. Chaussee, and John R. Spreiter Jan. 1978 71 p refs
(Contract NAS3-19738)
(NASA-CR-2941; NEAR-TR-136) Avail: NTIS HC A04/MF A01 CSCL 21E

A preliminary investigation was conducted to establish the theoretical basis of perturbation techniques with the objective of minimizing computational requirements associated with parametric studies of transonic flows in turbomachines. The theoretical analysis involved the development of perturbation methods for determining first order changes in the flow solution due to variations of one or more geometrical or flow parameters. The formulation is primarily directed toward transonic flows on the blade to blade surface of a single blade row compressor. Two different perturbation approaches were identified and studied. Applications and results of these methods for various perturbations are presented for selected two dimensional transonic cascade flows to illustrate the advantages and disadvantages of each technique. Additionally, it was found that, for flows with shock waves, proper account of shock displacement was crucial. Author

N78-15988*# Pratt and Whitney Aircraft, East Hartford, Conn.
AERO-ACOUSTIC TESTS OF DUCT-BURNING TURBOFAN EXHAUST NOZZLES. COMPREHENSIVE DATA REPORT. VOLUME 1: MODEL SCALE ACOUSTIC DATA Final Report
Hilary Kozlowski and Allan B. Packman Feb. 1977 440 p 3 Vol.
(Contract NAS3-17866)
(NASA-CR-134910; PWA-5336) Avail: NTIS HC A19/MF A01 CSCL 02A

A compilation of all the detailed acoustic and aerodynamic data covering static aero-acoustic tests of duct-burning turbofan exhaust nozzles is presented. The basic model scale acoustic data and acoustic data scaled to full size is tabulated. In addition, perceived noise levels are shown at various sideline distances. A graphical presentation of the data is also given. Author

N78-15989*# Pratt and Whitney Aircraft, East Hartford, Conn.
AERO-ACOUSTIC TESTS OF DUCT-BURNING TURBOFAN EXHAUST NOZZLES. COMPREHENSIVE DATA REPORT. VOLUME 2: ACOUSTIC AND AERODYNAMIC DATA Final Report
Hilary Kozlowski and Allan B. Packman Feb. 1977 570 p 3 Vol.
(Contract NAS3-17866)
(NASA-CR-134910; PWA-5336) Avail: NTIS HC A24/MF A01 CSCL 02A
For abstract, see N78-15988.

N78-15990*# Pratt and Whitney Aircraft, East Hartford, Conn.
AERO-ACOUSTIC TESTS OF DUCT-BURNING TURBOFAN EXHAUST NOZZLES. COMPREHENSIVE DATA REPORT. VOLUME 3: ACOUSTIC AND AERODYNAMIC DATA CURVES Final Report
Hilary Kozlowski and Allan B. Packman Feb. 1977 427 p 3 Vol.
(Contract NAS3-17866)
(NASA-CR-134910; PWA-5336) Avail: NTIS HC A19/MF A01 CSCL 02A
For abstract, see N78-15988.

N78-15991# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
AN INVESTIGATION INTO THE NATURE OF AIRCRAFT SUPPORTABILITY IN THE CILC ENVIRONMENT M.S. Thesis
Gordon S. Luna and Robert A. Stier Sep. 1977 128 p refs
(AD-A047226; AFIT-LSSR-13-77B) Avail: NTIS HC A07/MF A01 CSCL 01/5

This paper deals with the initial development of a generalized model representing the Centralized Intermediate Logistics Concept (CILC). The model can handle from 1 to 10 operating locations and many of the logistical variables including demand rates, repair cycle times, travel times, and base repair rates. The analysis includes a comparison of the traditional maintenance system to CILC and a trend analysis of the effects of demand rates, base repair rates, shipping times, repair times, and location strategy on supportability. Author (GRA)

N78-15992# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
AN ANALYSIS OF USER ACCEPTANCE AND PERCEIVED USABILITY OF C-141A JOB GUIDES M.S. Thesis
S. A. Richardson and Thomas E. Syster Sep. 1977 271 p refs
(AD-A047141; AFIT-LSSR-36-77B) Avail: NTIS HC A12/MF A01 CSCL 05/9

The C-141A was the first aircraft to use job guides. In 1976 AFHRL conducted a survey at the two bases which participated in the development of these job guides to determine their usability and degree of user acceptance. This thesis conducted a similar survey at two bases which did not participate in the

development of the C-141A Job Guide to determine if user attitudes about job guides was as favorable as found by AFHRL. Also tests were made to determine if there was any difference in attitudes between pay grades. Behavioral theory suggests that workers who participate in planning a change will have less resistance to that change and that younger workers resist change less than older workers. It was concluded that technicians at bases which did not participate in the development of the C-141A Job Guides had a lower acceptance of them, but there was no difference in perceived usability. No significant difference was found between grades for either user acceptance or perceived usability. Although acceptance of the C-141A Job Guides was high, actual on-the-job use of them appeared to be quite low, and could eliminate anticipated cost savings as suggested by previous experiments with job guides. Author (GRA)

N78-15993# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
AN EVALUATION OF THE CAPABILITY OF THE LOGISTICS COMPOSITE MODEL TO PROJECT THE MONTHLY AIRCRAFT SORTIE EFFECTIVENESS OF AN F-15 WING M.S. Thesis
Charles G. Davis and Clifford T. Smith Sep. 1977 103 p refs
(AD-A047227; AFIT-LSSR-2-77B) Avail: NTIS HC A06/MF A01 CSCL 01/5

There has been considerable research on computerized generation of alternative flying and maintenance schedules in an effort to improve utilization of Air Force resources. However, no technique exists to evaluate the potential sortie effectiveness of alternative schedules. The Logistics Composite Model (LCOM) appeared to have the potential to perform the evaluation through simulation. The authors investigated LCOMs capability to accurately predict the sortie effectiveness of F-15 monthly flying schedules by simulating six actual F-15 monthly flying and maintenance schedules. Analysis of the results indicated that LCOM could not effectively evaluate alternative F-15 monthly flying schedules. Author (GRA)

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N78-15994 Ohio State Univ., Columbus.
NUMERICAL SOLUTION OF WEAKLY SEPARATED SUPERSONIC FLOWS AT HIGH REYNOLDS NUMBER Ph.D. Thesis
Richard Jenson 1977 163 p
Avail: Univ. Microfilms Order No. 77-24644

When a supersonic laminar flow is disturbed by a change in the wall geometry an interaction takes place between the boundary layer and the external inviscid flow. For sufficiently small disturbances the limit structure for large Reynolds number is given by the triple-deck theory. The entire interaction problem is then reduced to the solution of the incompressible boundary-layer equations appropriate to the lower deck of this structure with an interaction boundary condition given by matching to the outer two decks. A quasi-unsteady iterative procedure was formulated to solve separated flows within this context. The central feature of this algorithm is the use of the interaction condition to retain the elliptic-like behavior of the system at each step of the iteration. The procedure is used to calculate flows for compression and expansion corners, backward-facing steps, and base flows. Dissert. Abstr.

N78-15995 Colorado Univ., Boulder.
NUMERICAL SOLUTION FOR SOME PROBLEMS CONCERNING UNSTEADY MOTION OF AIRFOILS Ph.D. Thesis
Yeou-Kuang Shung 1977 71 p
Avail: Univ. Microfilms Order No. 77-24290

The unsteady behavior of a wing of infinite span moving through an inviscid and incompressible fluid is studied by using the method of conformal mapping in combination with a numerical technique. When a small airplane is flying toward a line vortex left behind by a large aircraft, the lift and moment on the small airplane caused by the line vortex alone is computed. Numerical results have been obtained for various combinations of the speed and the position of the small airplane relative to the center of the line vortex. It is found that the small airplane may experience large fluctuations in both lift and moment when traversing through a strong line vortex. Dissert. Abstr.

N78-15996 Illinois Univ., Urbana-Champaign.
ON SOME STRUCTURE-TURBULENCE INTERACTION PROBLEMS Ph.D. Thesis
Shoji Maekawa 1977 117 p
Avail: Univ. Microfilms Order No. 77-26709

The interaction between a turbulent flow and certain types of structures responding to its excitation was studied. The turbulence was typical of those associated with a boundary layer, having a cross spectral density indicative of convection and statistical decay. A number of structural models were considered in the investigation, including an unsupported infinite beam and a periodically supported infinite beam. The results are presented in terms of the spectral densities of the structural response and the perturbation Reynolds stress in the fluid at the vicinity of the interface. It is found that important spectral peaks of the structural response will not appear if decays in the turbulence are neglected in the analysis. Dissert. Abstr.

N78-15997 Georgia Inst. of Tech., Atlanta.
AN IMPROVED METHOD OF CALCULATING THE TIP VORTEX GEOMETRY FOR HOVERING ROTORS Ph.D. Thesis
Satish S. Samant 1976 73 p
Avail: Univ. Microfilms Order No. 77-25615

Efforts were made to locate the cause of discrepancies in the performance analysis of hovering rotors. Accurate specification of the geometry of the vortex wake, particularly in the near wake, was of primary concern. The consistency requirement, that the velocity in the blades fixed reference system at a point on the a vortex filament must be tangential to the vortex filament referred to the same system, was developed in terms of the apparent velocity components. It was shown that the apparent velocity components calculated from a given vortex system using the Biot-Savart law do not satisfy these consistency requirements, but can be used to calculate the effect of the same vortex system at the blade very accurately. The discrepanices in the induced velocity are therefore thought to be the local effects of this small region and are then called the core effect.
Dissert. Abstr.

N78-15998*# National Aeronautics and Space Administration, Washington, D. C.
INSTABILITY OF A COMPRESSIBLE CIRCULAR FREE JET WITH CONSIDERATION OF THE INFLUENCE OF THE JET BOUNDARY LAYER THICKNESS
Alfons Michalke Dec. 1977 24 p refs Transl. into ENGLISH from Z. fur Flugwissenschaften (West-Germany), v. 19, no. 8/9, 1971 p 319-328 Transl. by SCITRAN, Santa Barbara, Calif. (Contract NASw-2791)
(NASA-TM-75190) Avail: NTIS HC A02/MF A01 CSCL 01A

The instability of a circular jet was investigated by means of the inviscid linearized stability theory. By variation of a jet parameter which takes the ratio of jet radius to boundary layer thickness into account, the influence of axisymmetry on the spatial growth rate and disturbance phase velocity is studied. The influence of Mach number and temperature ratio is discussed. A comparison with measurements shows that the instability of a turbulent jet boundary layer may also be explained by these results. Author

N78-15999*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
WIND-TUNNEL INVESTIGATION OF AERODYNAMIC PERFORMANCE, STEADY AND VIBRATORY LOADS, SURFACE TEMPERATURES, AND ACOUSTIC CHARACTERISTICS OF A LARGE-SCALE TWIN-ENGINE UPPER-SURFACE BLOWN JET-FLAP CONFIGURATION

Nov. 1976 153 p refs
(NASA-TN-D-8235; L-10753) Avail: NTIS HC A08/MF A01 CSCL 01A

Static and wind-on tests were conducted to determine the aerodynamic characteristics of and the effects of jet impingement on the wing of a large scale upper surface blown configuration powered with an actual turbine engine. The wing and flaps were instrumented with experimental dual-sensing transducer units consisting of a fluctuating pressure gage, a vibratory accelerometer, and a surface mounted alumel thermocouple. Noise directivity and spectral content measurements were obtained for various flap configurations and various engine thrust settings to provide baseline noise data for other upper surface blown configurations. A.R.H.

N78-16000*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LONGITUDINAL AERODYNAMIC CHARACTERISTICS AT MACH 0.60 TO 2.86 OF A FIGHTER CONFIGURATION WITH STRUT BRACED WING
Samuel M. Dollyhigh, William J. Monta, and Giuliana Sangiorgio Dec. 1977 149 p refs
(NASA-TP-1102; L-11801) Avail: NTIS HC A07/MF A01 CSCL 01A

An investigation was made to determine the effects on longitudinal aerodynamic characteristics of utilizing struts to brace the wing to allow the wing thickness reduction on the LFAX-8 fighter configuration. Structural and load analysis indicated that the maximum airfoil thickness could be reduced from 4.5 to 3.1 percent with the strut brace concept. Wave drag theory indicated that reducing the wing maximum thickness from 4.5 percent to 3.1 percent would yield a significant reduction in zero-lift wave drag of about 28 percent at the design Mach number of 1.60. Strut arrangements designed and tested included, a single straight strut, a single swept strut, and a set of tandem straight struts. In addition, a wire of approximately the same cross sectional area replaced the single straight strut on one series of runs. The original LFAX-8 with the 4.5-percent-thick wing was retested to serve as a base line for this investigation. Author

N78-16001*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COLD-AIR PERFORMANCE OF A TIP TURBINE DESIGNED TO DRIVE A LIFT FAN. 3: EFFECT OF SIMULATED FAN LEAKAGE ON TURBINE PERFORMANCE
Jeffrey E. Haas (Army R and T Labs.), Milton G. Kofskey, Glen M. Hotz, and Samuel M. Futral, Jr. Jan. 1978 28 p refs
(NASA-TP-1109; E-9331) Avail: NTIS HC A03/MF A01 CSCL 01A

Performance data were obtained experimentally for a 0.4 linear scale version of the LF460 lift fan turbine for a range of scroll inlet total to diffuser exit static pressure ratios at design equivalent speed with simulated fan leakage air. Tests were conducted for full and partial admission operation with three separate combinations of rotor inlet and rotor exit leakage air. Data were compared to the results obtained from previous investigations in which no leakage air was present. Results are presented in terms of mass flow, torque, and efficiency. Author

N78-16002*# Lockheed-California Co., Burbank.
A GENERALIZED VORTEX LATTICE METHOD FOR SUBSONIC AND SUPERSONIC FLOW APPLICATIONS
Luis R. Miranda, Robert D. Elliot, and William M. Baker Dec. 1977 371 p refs
(Contract NAS1-12972)
(NASA-CR-2865; LR-28112) Avail: NTIS HC A16/MF A01 CSCL 01A

If the discrete vortex lattice is considered as an approximation to the surface-distributed vorticity, then the concept of the generalized principal part of an integral yields a residual term to the vorticity-induced velocity field. The proper incorporation of this term to the velocity field generated by the discrete vortex lines renders the present vortex lattice method valid for supersonic flow. Special techniques for simulating nonzero thickness lifting surfaces and fusiform bodies with vortex lattice elements are included. Thickness effects of wing-like components are simulated by a double (biplanar) vortex lattice layer, and fusiform bodies are represented by a vortex grid arranged on a series of concentrical cylindrical surfaces. The analysis of sideslip effects by the subject method is described. Numerical considerations peculiar to the application of these techniques are also discussed. The method has been implemented in a digital computer code. A users manual is included along with a complete FORTRAN compilation, an executed case, and conversion programs for transforming input for the NASA wave drag program. Author

N78-16003*# Boeing Vertol Co., Philadelphia, Pa.
TWO-DIMENSIONAL WIND TUNNEL TEST OF AN OSCILLATING ROTOR AIRFOIL, VOLUME 1 Final Report
L. U. Dadone Dec. 1977 163 p refs
(Contract NAS1-13795)
(NASA-CR-2914; D210-11188-1-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 01A

A two dimensional wind tunnel test was conducted to obtain the quasisteady and unsteady characteristics of an advanced airfoil designed for helicopter rotor applications. Differential pressures were measured at 17 locations along the chord of the airfoil model. The airfoil motions were sinusoidal forced-pitch oscillations about the quarter chord at amplitudes varying from 2.5 to 10.0 degrees and at frequencies from 23 Hz to 90 Hz. The quasisteady tests were conducted at Mach numbers from 0.2 to 0.9, and the oscillatory tests between M = 0.2 and M = 0.7. At quasisteady conditions a limited number of drag measurements were made with a wake-traversing probe. Author

N78-16004*# General Dynamics/Convair, San Diego, Calif.
FEASIBILITY STUDY OF AN INTEGRATED PROGRAM FOR AEROSPACE-VEHICLE DESIGN (IPAD) SYSTEM. VOLUME 1: SUMMARY
C. A. Garrocq and M. J. Hurley 30 Aug. 1973 78 p refs
(Contract NAS1-11431)
(NASA-CR-132401) Avail: NTIS HC A05/MF A01 CSCL 01C

An overview is provided of the Ipad System, including its goals and objectives, organization, capabilities and future usefulness. The systems implementation is also presented with operational cost summaries. B.L.P.

N78-16005*# General Dynamics/Convair, San Diego, Calif.
FEASIBILITY STUDY OF AN INTEGRATED PROGRAM FOR AEROSPACE-VEHICLE DESIGN (IPAD) SYSTEM. VOLUME 2: CHARACTERIZATION OF THE IPAD SYSTEM, PHASE 1, TASK 1
C. A. Garrocq and J. J. Hosek 30 Aug. 1973 128 p refs
Prepared in cooperation with Control Data Corp., San Diego, Calif.
(Contract NAS1-11431)
(NASA-CR-132402) Avail: NTIS HC A07/MF A01 CSCL 01C

The aircraft design process is discussed along with the degree of participation of the various engineering disciplines considered in this feasibility study. Author

N78-16006*# General Dynamics/Convair, San Diego, Calif.
FEASIBILITY STUDY OF AN INTEGRATED PROGRAM FOR AEROSPACE-VEHICLE DESIGN (IPAD) SYSTEM. VOLUME 3: ENGINEERING CREATIVE/EVALUATION PROCESSES, PHASE 1, TASK 2
C. A. Garrocq and J. J. Hosek 30 Aug. 1973 184 p refs
Prepared in cooperation with Control Data Corp., San Diego, Calif.
(Contract NAS1-11431)
(NASA-CR-132403) Avail: NTIS HC A09/MF A01 CSCL 01C

A series of functional flow charts are considered that were developed to properly identify and record the degree of participation of the disciplines considered in this feasibility study and the type of data required in the design process. Author

N78-16007*# General Dynamics/Convair, San Diego, Calif.
FEASIBILITY STUDY OF AN INTEGRATED PROGRAM FOR AEROSPACE-VEHICLE DESIGN (IPAD) SYSTEM. VOLUME 4: DESIGN OF THE IPAD SYSTEM. PART 1: IPAD SYSTEM DESIGN REQUIREMENTS, PHASE 1, TASK 2

C. A. Garrocq and M. J. Hurley 20 Aug. 1973 250 p Prepared in cooperation with Control Data Corp., San Diego, Calif.
(Contract NAS1-11431)
(NASA-CR-132404) Avail: NTIS HC A11/MF A01 CSCL 01C

System requirements, software elements, and hardware equipment required for an IPAD system are defined. An IPAD conceptual design was evolved, a potential user survey was conducted, and work loads for various types of interactive terminals were projected. Various features of major host computing systems were compared, and target systems were selected in order to identify the various elements of software required.
Author

N78-16008*# General Dynamics/Convair, San Diego, Calif.
FEASIBILITY STUDY OF AN INTEGRATED PROGRAM FOR AEROSPACE-VEHICLE DESIGN (IPAD) SYSTEM. VOLUME 5: DESIGN OF THE IPAD SYSTEM. PART 2: SYSTEM DESIGN. PART 3: GENERAL PURPOSE UTILITIES, PHASE 1, TASK 2
C. A. Garrocq and M. J. Hurley 30 Aug. 1973 437 p refs Prepared in cooperation with Control Data Corp., San Diego, Calif.
(Contract NAS1-11431)
(NASA-CR-132405) Avail: NTIS HC A19/MF A01 CSCL 01C

Viable designs are presented of various elements of the IPAD framework software, data base management system, and required new languages in relation to the capabilities of operating systems software. A thorough evaluation was made of the basic systems functions to be provide by each software element, its requirements defined in the conceptual design, the operating systems features affecting its design, and the engineering/design functions which it was intended to enhance.
Author

N78-16009*# General Dynamics/Convair, San Diego, Calif.
FEASIBILITY STUDY OF AN INTEGRATED PROGRAM FOR AEROSPACE-VEHICLE DESIGN (IPAD) SYSTEM. VOLUME 6: IMPLEMENTATION SCHEDULE, DEVELOPMENT COSTS, OPERATIONAL COSTS, BENEFIT ASSESSMENT, IMPACT ON COMPANY ORGANIZATION, SPIN-OFF ASSESSMENT, PHASE 1, TASKS 3 TO 8
C. A. Garrocq, M. J. Hurley, M. Dublin et al 30 Aug. 1973 168 p refs 7 Vol.
(Contract NAS1-11431)
(NASA-CR-132406) Avail: NTIS HC A08/MF A01 CSCL 01C

A baseline implementation plan, including alternative implementation approaches for critical software elements and variants to the plan, was developed. The basic philosophy was aimed at: (1) a progressive release of capability for three major computing systems, (2) an end product that was a working tool, (3) giving participation to industry, government agencies, and universities, and (4) emphasizing the development of critical elements of the IPAD framework software. The results of these tasks indicate an IPAD first release capability 45 months after go-ahead, a five year total implementation schedule, and a total developmental cost of 2027 man-months and 1074 computer hours. Several areas of operational cost increases were identified mainly due to the impact of additional equipment needed and additional computer overhead. The benefits of an IPAD system were related mainly to potential savings in engineering man-hours, reduction of design-cycle calendar time, and indirect upgrading of product quality and performance.
Author

N78-16010*# Boeing Commercial Airplane Co., Seattle, Wash.
FEASIBILITY STUDY OF AN INTEGRATED PROGRAM FOR AEROSPACE VEHICLE DESIGN (IPAD). VOLUME 1A: SUMMARY
R. E. Miller, Jr., D. D. Redhed, A. S. Kawaguchi, S. D. Hansen, and J. W. Southall 21 Sep. 1973 69 p refs 7 Vol.
(Contract NAS1-11441)
(NASA-CR-132390; D6-60181-1A) Avail: NTIS HC A04/MF A01 CSCL 01C

IPAD was defined as a total system oriented to the product design process. This total system was designed to recognize the product design process, individuals and their design process tasks, and the computer-based IPAD System to aid product design. Principal elements of the IPAD System include the host computer and its interactive system software, new executive and data management software, and an open-ended IPAD library of technical programs to match the intended product design process. The basic goal of the IPAD total system is to increase the productivity of the product design organization. Increases in individual productivity were feasible through automation and computer support of routine information handling. Such proven automation can directly decrease cost and flowtime in the product design process.
Author

N78-16011*# Boeing Commercial Airplane Co., Seattle, Wash.
FEASIBILITY STUDY OF AN INTEGRATED PROGRAM FOR AEROSPACE VEHICLE DESIGN (IPAD). VOLUME 1B: CONCISE REVIEW
R. E. Miller, Jr., J. W. Southall, A. S. Kawaguchi, and D. D. Redhed 21 Sep. 1973 211 p refs 7 Vol.
(Contract NAS1-11441)
(NASA-CR-132391; D6-60181-1B) Avail: NTIS HC A10/MF A01 CSCL 01C

Reports on the design process, support of the design process, IPAD System design catalog of IPAD technical program elements, IPAD System development and operation, and IPAD benefits and impact are concisely reviewed. The approach used to define the design is described. Major activities performed during the product development cycle are identified. The computer system requirements necessary to support the design process are given as computational requirements of the host system, technical program elements and system features. The IPAD computer system design is presented as concepts, a functional description and an organizational diagram of its major components. The cost and schedules and a three phase plan for IPAD implementation are presented. The benefits and impact of IPAD technology are discussed.
Author

N78-16012*# Boeing Commercial Airplane Co., Seattle, Wash.
FEASIBILITY STUDY OF AN INTEGRATED PROGRAM FOR AEROSPACE VEHICLE DESIGN (IPAD). VOLUME 2: THE DESIGN PROCESS Final Report
W. B. Gillette, M. J. Turner, J. W. Southall, P. C. Whitener, and J. S. Kowalik 21 Sep. 1973 293 p refs
(Contract NAS1-11441)
(NASA-CR-132392; D6-60181-2) Avail: NTIS HC A13/MF A01 CSCL 01C

The extent to which IPAD is to support the design process is identified. Case studies of representative aerospace products were developed as models to characterize the design process and to provide design requirements for the IPAD computing system.
Author

N78-16013*# Boeing Commercial Airplane Co., Seattle, Wash.
FEASIBILITY STUDY OF AN INTEGRATED PROGRAM FOR AEROSPACE VEHICLE DESIGN (IPAD). VOLUME 3: SUPPORT OF THE DESIGN PROCESS Final Report
W. B. Gillette, S. D. Hansen, R. E. Bateman, and J. W. Southall 21 Sep. 1973 136 p refs
(Contract NAS1-11441)
(NASA-CR-132393; D6-60181-3) Avail: NTIS HC A07/MF A01 CSCL 01C

The user requirements for computer support of the IPAD design process are identified. The user-system interface, language, equipment, and computational requirements are considered.
Author

N78-16014*# Boeing Commercial Airplane Co., Seattle, Wash.
FEASIBILITY STUDY OF AN INTEGRATED PROGRAM FOR AEROSPACE VEHICLE DESIGN (IPAD). VOLUME 4: IPAD SYSTEM DESIGN Final Report
W. Goldfarb, L. C. Carpenter, D. D. Redhed, S. D. Hansen, L. O. Anderson, and A. S. Kawaguchi 21 Sep. 1973 367 p refs
(Contract NAS1-11441)
(NASA-CR-132394; D6-60181-4) Avail: NTIS HC A16/MF A01 CSCL 01C

The computing system design of IPAD is described and the requirements which form the basis for the system design are discussed. The system is presented in terms of a functional design description and technical design specifications. The functional design specifications give the detailed description of

the system design using top-down structured programming methodology. Human behavioral characteristics, which specify the system design at the user interface, security considerations, and standards for system design, implementation, and maintenance are also part of the technical design specifications. Detailed specifications of the two most common computing system types in use by the major aerospace companies which could support the IPAD system design are presented. The report of a study to investigate migration of IPAD software between the two candidate 3rd generation host computing systems and from these systems to a 4th generation system is included. Author

N78-16015*# Boeing Commercial Airplane Co., Seattle, Wash.
FEASIBILITY STUDY OF AN INTEGRATED PROGRAM FOR AEROSPACE VEHICLE DESIGN (IPAD). VOLUME 5: CATALOG OF IPAD TECHNICAL PROGRAM ELEMENTS Final Report
W. B. Gillette, ed. and J. W. Southall, ed. 21 Sep. 1973 364 p refs
(Contract NAS1-11441)
(NASA-CR-132395; D6-60181-5) Avail: NTIS HC A16/MF A01 CSCL 01C

The catalog is presented of technical program elements which are required to support the design activities for a subsonic and supersonic commercial transport. Information for each element consists of usage and storage information, ownership, status and an abstract describing the purpose of the element. Author

N78-16016*# Boeing Commercial Airplane Co., Seattle, Wash.
FEASIBILITY STUDY OF AN INTEGRATED PROGRAM FOR AEROSPACE VEHICLE DESIGN (IPAD). VOLUME 6: IPAD SYSTEM DEVELOPMENT AND OPERATION Final Report
D. D. Redhed, L. L. Tripp, A. S. Kawaguchi, and R. E. Miller, Jr. 21 Sep. 1973 115 p refs
(Contract NAS1-11441)
(NASA-CR-132396; D6-60181-6) Avail: NTIS HC A06/MF A01 CSCL 01C

The strategy of the IPAD implementation plan presented, proposes a three phase development of the IPAD system and technical modules, and the transfer of this capability from the development environment to the aerospace vehicle design environment. The system and technical module capabilities for each phase of development are described. The system and technical module programming languages are recommended as well as the initial host computer system hardware and operating system. The cost of developing the IPAD technology is estimated. A schedule displaying the flowtime required for each development task is given. A PERT chart gives the developmental relationships of each of the tasks and an estimate of the operational cost of the IPAD system is offered. Author

N78-16017*# Boeing Commercial Airplane Co., Seattle, Wash.
FEASIBILITY STUDY OF AN INTEGRATED PROGRAM FOR AEROSPACE VEHICLE DESIGN (IPAD) VOLUME 7: IPAD BENEFITS AND IMPACT Final Report
S. D. Hansen and J. W. Southall 21 Sep. 1973 119 p refs
(Contract NAS1-11441)
(NASA-CR-132397; D6-60181-7) Avail: NTIS HC A06/MF A01 CSCL 01C

The potential benefits, impact and spinoff of IPAD technology are described. The benefits are projected from a flowtime and labor cost analysis of the design process and a study of the flowtime and labor cost savings being experienced with existing integrated systems. Benefits in terms of designer productivity, company effectiveness, and IPAD as a national resource are developed. A description is given of the potential impact of information handling as an IPAD technology, upon task and organization structure and people who use IPAD. Spinoff of IPAD technology to nonaerospace industries is discussed. The results of a personal survey made of aerospace, nonaerospace, government and university sources are given. Author

N78-16018*# New York Univ., N. Y. Courrant Mathematics and Computing Lab.
LECTURE NOTES IN ECONOMICS AND MATHEMATICAL SYSTEM. VOLUME 150: SUPERCRITICAL WING SECTIONS 3
Frances Bauer, Paul Garabedian, and David Korn Nov. 1977 184 p
(Grants NGR-33-016-167; NGR-33-016-201; Contract EY-76-C-02-3077)
(NASA-CR-155581; ISBN-3-540-08533-5; ISBN-0-387-08533-5) Avail: NTIS HC A09/MF A01 CSCL 01A

Application of computational fluid dynamics to the design and analysis of supercritical wing sections is discussed. Computer programs used to study the flight of modern aircraft at high subsonic speeds are listed and described. The cascades of shockless transonic airfoils that are expected to increase the efficiency of compressors and turbines are included. J.M.S.

N78-16019# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
A THEORETICAL AND EXPERIMENTAL STUDY ON THE FLOW OF RAREFIED GAS PASTA SPHERE
M. Tomoeda May 1977 156 p refs
(Grant AF-AFOSR-2091-71)
(UTIAS-216; CN-ISSN-0082-5255) Avail: NTIS HC A08/MF A01

The flow of a rarefied gas over a sphere was studied for the case of the speed ratio, the ratio of the flow speed to the thermal speed, and small compared with unity. The Bhatnagar, Gross and Krook, and Welander model of the Boltzmann equation was used and a small perturbation technique was employed to remove the difficulties arising from the nonlinearity implicit in the BGKW model equation. The fundamental equations as well as the associated boundary conditions were expanded into power series in terms of small nondimensional perturbations of the molecular distribution function and the macroscopic flow properties. Further expansions in the asymptotic field were made in terms of a small Knudsen number. Author

N78-16020# Piasecki Aircraft Corp., Philadelphia, Pa.
HYBRID LTA VEHICLE CONTROLLABILITY AS AFFECTED BY THRUSTER MAGNITUDE AND SPACING Final Report, Feb. - Jun. 1977
Donald N. Meyers 1 Jul. 1977 148 p
(Contract N62269-77-C-0099; WF 41411000)
(AD-A047196; NADC-76327-30) Avail: NTIS HC A07/MF A01 CSCL 01/3

Results of an analytical investigation are presented which show the effects on low speed maneuverability of several geometric and dynamic parameters of a hybrid lighter-than-air (LTA) vehicle. Most significant of these parameters are: ratio of static lift to gross weight; relative spacing of vertical thrusters; relative amount and direction of available horizontal thrust. The analysis, which is based on nine 'point designs' representation of real vehicles, takes into account the increased moment of inertia associated with increased spacing of the dynamic thrusters. Author (GRA)

N78-16021# Stevens Inst. of Tech., Hoboken, N. J.
RESEARCH ON THE FLUTTER OF AXIAL-TURBOMACHINE BLADING
F. Sisto Nov. 1977 46 p refs
(Contract N00014-76-C-0540)
(AD-A047086; ME-RT-77004) Avail: NTIS HC A03/MF A01 CSCL 01/3

The dynamic stall of an airfoil with leading edge bubble separation is analyzed. The stall flutter of turbomachine blading often involves periodic growth and collapse of such a bubble. The mathematical model representing the physical problem is presented. A flat plate undergoing harmonic oscillations with time dependent point of re-attachment is studied for the perturbed aerodynamic reactions and applications to the stall flutter problem. Author (GRA)

N78-16022# Arizona Univ., Tucson. Dept. of Aerospace and Mechanical Engineering.
SMALL UNSTEADY PERTURBATIONS IN TRANSONIC FLOWS
K-Y. Fung, N. J. Yu, and R. Seebass Nov. 1977 30 p refs
(Contract N00014-76-C-0182; Grant AF-AFOSR-2954-76)
(AD-A046923) Avail: NTIS HC A03/MF A01 CSCL 20/4

The effects of very small, low frequency, perturbations to steady transonic flows are investigated for two-dimensional flows

described by the small perturbation equation. A method that allows one to account for shock wave motions due to arbitrary, but small, unsteady changes in the boundary conditions is described. Both harmonic and indicial responses may be calculated. Time-linearized results for transonic flow past an NACA 64A006 airfoil experiencing harmonic motions in one of several modes are presented. Author (GRA)

N78-16023# Naval Ship Research and Development Center, Bethesda, Md.
THEORETICAL ASPECTS OF DROMEDARYFOIL Interim Report, Jan. 1976 - Jan. 1977
Tsze C. Tai Nov. 1977 39 p refs
(RR02302001)
(AD-A047150; DTNSRDC-77-0104) Avail: NTIS HC A03/MF A01 CSCL 20/4

A new airfoil design (called a dromedaryfoil) has been developed using a single hump on a modified supercritical airfoil for limiting the center of pressure excursion and maximizing the drag divergence Mach number. Derivation of the hump is based on isentropic compression in the fore part and incipient separation in the rear. The former leads to a weakened shock wave and the latter to high pressure recovery after the shock. The shock will theoretically locate at the peak of the hump to form a fixed pressure pattern under different flight speeds. The shock foot will be inclined at a deflection angle of the hump measured from the normal of the fore hump surface at the peak. Theoretical results indicate considerably shorter center-of-pressure travel for a dromedaryfoil than for a supercritical airfoil with equal wave drag. However, improper humping would be penalized by increased wave drag. At high supercritical flows, the shock strength would be limited by (M sub 1 sin beta)max = 1.483. Experimental verification of theoretical predictions is planned. Author (GRA)

N78-16024# Aircraft Research and Development Unit, Laverton (Australia).
EVALUATION OF SLIMPACK STYLE PARACHUTE IN CT4A AIRTRAINER AIRCRAFT
Nov. 1976 31 p refs
(AD-A047083; TI-556) Avail: NTIS HC A03/MF A01 CSCL 01/3

The Slimpak style parachute was being evaluated, under Technical Investigation 517, for use in place of the standard 'Flexible Back' parachute which had proven unsatisfactory in helicopter operations when worn by large crew members. Some instructors and students of No 1 Flying Training School, of rather large build, were unable to wear the Flexible Back parachute in the CT4A Airtrainer because of restriction to control column deflection. Headquarters Support Command considered that the Slimpak style parachute might be suitable for use in the Airtrainer by the large crew memebers and ARDU was directed to investigate this possibility. Ground and flight trials were conducted using a wide range of aircrew sizes. Dropping trials were carried out under Technical Investigation 517. The 'Slimpak' model parachute as tested was found to be unacceptable for use in the Airtrainer by aircrew with a buttock to heel length of less than about 1.02 m. It was also found to have major deficiencies in design and operation of the harness and associated buckles that would render it unsuitable in its present form for use by the RAAF in any other aircraft. Author (GRA)

N78-16025# Transportation Systems Center, Cambridge, Mass.
AIRCRAFT WAKE VORTICES: A STATE-OF-THE-ART REVIEW OF THE UNITED STATES R AND D PROGRAM Final Report, Oct. - Dec. 1976
J. N. Haddock, ed. and W. R. Eberle, ed Feb. 1977 349 p refs Prepared in cooperation with Lockheed Missiles and Space Co., Huntsville, Ala.
(AD-A042442; TSC-FAA-77-4; FAA-RD-77-23) Avail: NTIS HC A15/MF A01

A summary of the current state-of-the-art understanding of the aircraft wake vortex phenomenon is presented, and the results of the United States program to minimize the restrictions caused by aircraft wake vortices in the terminal environment are included. The vortex phenomenon, vortex avoidance systems, and vortex alleviation techniques were also discussed. Author (GRA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N78-16026*# Boeing Vertol Co., Philadelphia, Pa.
RESEARCH REQUIREMENTS TO IMPROVE SAFETY OF CIVIL HELICOPTERS
Kenneth T. Waters Nov. 1977 77 p refs
(Contract NAS1-13624)
(NASA-CR-145620) Avail: NTIS HC A05/MF A01 CSCL 01C

Helicopter and fixed-wing accident data were reviewed and major accident causal factors were established. The impact of accidents on insurance rates was examined and the differences in fixed-wing and helicopter accident costs discussed. The state of the art in civil helicopter safety was compared to military helicopters. Goals were established based on incorporation of known technology and achievable improvements that require development, as well as administrative-type changes such as the impact of improved operational planning, training, and human factors effects. Specific R and D recommendations are provided with an estimation of the payoffs, timing, and development costs. Author

N78-16027# Federal Aviation Administration, Washington, D. C.
TERMINAL AREA FORECAST 1978-1988
Jan. 1977 355 p
(AD-A046543; FAA-AVP-77-17) Avail: NTIS HC A16/MF A01 CSCL 01/2

This report contains forecasts for air carrier and air taxi enplanements, air carrier and air taxi aircraft operations, itinerant, total and instrument aircraft operations, and instrument approaches at 894 airports throughout the United States. The airports in this publication include all those with Federal Aviation Administration air traffic control towers and those with air carrier service. The report is intended as an aid for anticipating future manpower and equipment needs at terminal areas. Author (GRA)

N78-16028# Transportation Systems Center, Cambridge, Mass.
AIRLINE DELAY TRENDS, 1974-1975. A STUDY OF BLOCK TIME DELAYS, GROUND AND AIRBORNE, FOR SCHEDULED AIR CARRIERS Annual Report
Helen M. Condell, Seymour M. Horowitz, and Alan S. Kaprelian Mar. 1977 218 p
(AD-A039483; TSC-FAA-77-6; FAA-EM 77-2) Avail: NTIS HC A10/MF A01 CSCL 01/2

Estimates of block, airborne and ground delays for route segments flown by United States domestic scheduled airlines operating out of twenty large airports are presented in this document. The data were determined from the CAB ER-586 Service Segment data base, which provides monthly operational times, both ground and airborne, for all route segments receiving scheduled air carrier service. The data in this report are limited to the three-hundred and thirty route segments connecting the twenty airports included in the study. Average monthly estimates of the ground and airborne components of block delays, defined as delays encountered from 'ramp to ramp' on a route segment, are presented for the two-year period from 1974-1975. Average monthly estimates of delays for the airborne portion of the segment 'wheel off' to 'wheels on' are categorized according to 1 Route segment, 2 airline, 3 aircraft type and 4 local scheduled arrival or departure time. Average monthly estimates of delays for the ground portion of the route segments are categorized according to departure and arrival ground times at the twenty airport locations included in the study. These estimates of ground delays are further categorized into 'busy' time intervals 0700 - 2259 and 'dull' time intervals 2300 - 0659. Author (GRA)

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N78-16029# National Aviation Facilities Experimental Center, Atlantic City, N. J.
SIMULATION TESTS OF FLIGHT TECHNICAL ERROR IN 2D/3D AREA NAVIGATION (RNAV) USING A MULTIPLE WAYPOINT RNAV SYSTEM WITH AND WITHOUT A FLIGHT DIRECTOR SYSTEM Final Report, Nov. 1975 - Jan. 1977
Donald Eldredge, Warren G. Crook, and William R. Crimbring Oct. 1977 101 p refs
(AD-A047246; FAA-NA-77-10) Avail: NTIS HC A06/MF A01 CSCL 17/7

Six pilots participated in a series of flight simulation tests employing solo pilot techniques which were conducted in order to measure total system crosstrack (TSCT) and flight technical error using a multiple waypoint storage 2D/3D area navigation (RNAV) system. The tests were designed to assess pilot performance as a function of the interexperimental variables: (1) 2D RNAV mode versus 3D RNAV mode, (2) flight director versus no flight director, (3) insertion of an impromptu waypoint into a previously entered flight plan, and (4) different route structures. Performance was measured on the variables: horizontal tracking, vertical tracking, airspeed control, and procedural performance. Author

N78-16030# National Aviation Facilities Experimental Center, Atlantic City, N. J.
INTERMITTENT POSITIVE CONTROL. PHASE 1: OPERATIONAL TEST AND EVALUATION Interim Report, Jul. - Sep. 1976
John W. Goodwin Oct. 1977 19 p refs
(AD-A047249; FAA-NA-77-12) Avail: NTIS HC A02/MF A01 CSCL 17/7

In testing this interface, the IPC algorithm was resident in the Digital Simulation Facility, which simulated the operation of a discrete address beacon system. The test series was operationally oriented and did not consider such factors as program size, loading factors, or processing time. The results of the tests reveal that the IPC controller alerts, consistency of commands, readability of displayed information, and method of displaying information to the controllers were acceptable. The issuance of negative commands to aircraft presents a problem to the controllers, in that negative phraseology is not utilized in the air traffic control system. The alerting methods of IPC and conflict alert are similar, but because of the critical timing of the IPC alert, it was felt that a distinctly different alert for IPC should be utilized. Author

N78-16031# Mitre Corp., McLean, Va.
INITIAL COLLISION AVOIDANCE ALGORITHMS FOR THE BEACON-BASED COLLISION AVOIDANCE SYSTEM
J. Clark and A. McFarland Apr. 1977 96 p refs
(Contract DOT-FA69NS-162)
(AD-A047254; MTR-7532; FAA-RD-77-163) Avail: NTIS HC A05/MF A01 CSCL 17/7

A set of baseline collision avoidance algorithms are described which can be used as a point of departure for the development of final algorithms for the beacon-based collision avoidance system. The algorithms were structured to permit great flexibility in an experimental environment, and incorporate a number of selectable options in the collision avoidance logic and in the display output. One option permits the selection of either a passive mode logic or an active mode logic. When the passive mode is selected, other options allow horizontal positive or negative commands to be used. In addition, the display of positive or negative commands can be selected or suppressed, and limit vertical rate commands can be selected for display independently of positive or negative commands. Two types of intruder position data can also be selected for display. The logic can drive three types of cockpit displays. Author

N78-16032# Mitre Corp., McLean, Va. METREK Div.
ASSESSMENT OF THE PERFORMANCE OF AN ACTIVE ATCRBS MODE FOR BEACON COLLISION AVOIDANCE
N. A. Spencer, Paul M. Ebert, and Leonard T. Moses Dec. 1977 132 p refs
(Contract DOT-FA69NS-162)
(AD-A047670; MTR-7645; FAA-RD-77-151) Avail: NTIS HC A07/MF A01 CSCL 01/2

The active air traffic control radar beacon system mode of the beacon collision avoidance system (BCAS) was tested in a National Aviation Facilities Experiment Center (NAFEC) airborne test bed. After conducting many flights for purposes of the system shakedown, design refinement, and the setting of parameters, a series of detailed data collection flights was run. The results of approximately 100 one-on-one aircraft encounters were presented in which the ability of BCAS to give a proper maneuver command was examined; then results of one and one-quarter hours of data on targets-of-opportunity in the environment of the Washington, D. C. TCA. flights with a controlled target in the airspace near NAFEC were examined to explore the effects of antenna coverage. A comparison was made between the results obtained in Washington, those from NAFEC flights and those from simulated scenarios were fed into the operating processor. Author

N78-16033# Naval Surface Weapons Center, White Oak, Md. Research and Technology Dept.
A DIGITAL COMPASS
Daniel S Lenko Sep. 1977 37 p
(SF3330031)
(AD-A047012; NSWC/WOL/TR-77-98) Avail: NTIS HC A03/MF A01 CSCL 17/7

A digital magnetic compass has been developed using a two axis Brown type ring core magnetometer as earth's magnetic field sensor. Bearing is derived via a trigonometric algorithm where a commercially available calculator chip performs the required mathematical computations. Designed primarily for slow moving applications, the portable digital compass has a 4 digit LED bearing display and may be operated on internal batteries or from an external ac power supply. Author (GRA)

N78-16034# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
A FUNCTIONAL DESCRIPTION OF THE NAVSTAR GPS RECEIVER MODEL X, VOLUME 1 Final Report, Nov. 1975 - Jun. 1977
William M. Stonestreet 26 Apr. 1976 76 p
(Contract F04701-75-C-0212)
(AD-A047201; R-981-Vol-1; SAMSO-TR-77-120-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 17/7

Draper Laboratory is under contract to the Global Positioning System (GPS) Joint Program Office (JPO) to develop the interface requirements between the GPS X-set being developed by Magnavox Advanced Product Division under subcontract to General Dynamics and the Advanced Inertial Reference System (AIRS). Since the X-set is still under development, a suitable description of it must be created in order to develop this interface. With the exception of the data processor and the X-receiver calibration and automatic-fault indicator operations, this report functionally describes the operations performed by the X-set. The descriptions contained herein are based upon the documentation and specifications currently available and technical discussions with the GPS JPO. Author (GRA)

N78-16035# Stanford Telecommunications, Inc., McLean, Va.
THE SINGLE-SITE COLLISION AVOIDANCE SYSTEM (SS-CAS)
L. Schuchman and R. Orr 16 Sep. 1977 151 p refs Sponsored in part by FAA
(Contract F04701-75-C-0239)
(AD-A045977; FAA-EM-77-8) Avail: NTIS HC A08/MF A01 CSCL 17/7

SS-CAS is a unique beacon collision avoidance system which works in conjunction with the current and next generation air traffic control surveillance systems (ATCRBS and DABS). In its passive mode, SS-CAS provides three dimensional positions of both user and target aircraft using beacon replies from only one ground-based DABS or ATCRBS interrogator. Full collision avoidance service is provided in both the all-ATCRBS environment

of today, the all-DABS environment of tomorrow, and the intervening transition period. The ground and airborne equipments required are add-ons to the ground beacon and the airborne DABS units. A two-way data link separate from, but compatible in format with, the DABS data link provides the SS-CAS-Equipped aircraft with important site data. A tracker capable of reading reliable tracks through ATCRBS synchronous garble is employed. DABS replies arrive garble-free at the SS-CAS aircraft and are simple to track. An active mode and multi-site usage capability are available for performance enhancement in identified special situations. This report fully describes the SS-CAS concept as it functions in the all-ATCRBS, all-DABS and transition environments. Author (GRA)

N78-16036# National Aviation Facilities Experimental Center, Atlantic City, N. J.
AN ANALYSIS OF RADIO NAVIGATION SENSOR ACCURACIES ASSOCIATED WITH AREA NAVIGATION (RNAV) Interim Report, Aug. - Sep. 1975
Robert H. Pursel Feb. 1977 36 p
(FAA Proj. 044-326-100)
(AD-A035619; FAA-NA-76-26; FAA-RD-76-113) Avail: NTIS HC A03/MF A01 CSCL 17/7

Flight test data gathered during a series of RNAV flight tests at the National Aviation Facilities Experimental Center NAFEC in Atlantic City, New Jersey, are presented. The report concentrates on the radio navigation sensor errors and the resulting errors in position determination that are inherent in area navigation RNAV operation in the terminal area. Statistical data as well as distributions of the errors are presented. One standard deviations of 1.5 degrees for very high frequency omnidirectional radio range VOR and 0.094 nautical mile for distance measuring equipment DME were computed from the flight test data. These statistics represent combined ground and airborne sensor errors. Author (GRA)

N78-16037# Transportation Systems Center, Cambridge, Mass.
AIRPORT SURFACE TRAFFIC CONTROL VISUAL GROUND AIDS ENGINEERING AND DEVELOPMENT PLAN Interim Report, Jun. 1975 - Oct. 1976
F. D. MacKenzie Jan. 1977 68 p refs
(AD-A038153; TSC-FAA-76-26; FAA-RD-77-16) Avail: NTIS HC A04/MF A01 CSCL 01/5

The plan described in this document supports the overall program at the Transportation Systems Center to define, design, develop, and evaluate systems that meet the requirements of airport surface traffic control. This plan is part of documentation supporting one aspect of the program, visual ground aids development. There are twenty-four concerns with the present visual ground aids. The concerns deal with the ability of the present system and its components to support taxiing operations in the lower visibility environment found during Category III conditions. This report describes an engineering and development plan which will identify solutions for the concerns, create the specifications for improved visual ground aids and lay the ground work for application in future Category III operations. The management of the development process leading to major improvements in the present system is described. The plan includes a schedule, budget, milestones and evaluation criteria. Author (GRA)

N78-16038# Transportation Systems Center, Cambridge, Mass.
AIRPORT SURFACE TRAFFIC CONTROL TAGS PLANNING ALTERNATIVES AND COST/BENEFIT ANALYSIS Final Report, Dec. 1975 - Mar. 1976
Paul S. Rempfer Jan. 1977 51 p refs
(AD-A037790; TSC-FAA-76-23; FAA-RD-77-9) Avail: NTIS HC A04/MF A01 CSCL 17/7

The findings of a cost/benefit analysis of the deployment of a new airport ground surveillance system TAGS (Tower Automated Ground Surveillance) are presented. TAGS will provide a plan view display of aircraft on the airports taxiways and runways like ground surveillance radar (ASDE); but unlike ASDE, TAGS will perform in heavy precipitation and automatically acquire and display aircraft flight identity. The findings indicate that a TAGS deployment of between four and nine systems is cost/beneficial. The development plan, system costs, analysis approach and sensitivity analysis supporting the findings are provided. Author (GRA)

N78-16039# Transportation Systems Center, Cambridge, Mass.
TERRESTRIAL RADIODETERMINATION PERFORMANCE AND COST Interim Report, Dec. 1975 - Sep. 1976
Edwin H. Farr and Ralph D. Kodis Sep. 1977 52 p refs
(PB-273401/0; DOT-TSC-OST-77-8) Avail: NTIS HC A04/MF A01 CSCL 17G

Electronic techniques are applied to geographical position determination on land and on inland waterways. Systems incorporating such techniques have been called terrestrial radiodetermination (TRD) systems. Their most common application to date has been to locate and track a large number of vehicles in real time. The report describes the performance of several leading systems that employ TRD. These systems are or have been operational to some degree. Cost data are also given. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N78-16040 Aeronautical Research Labs., Melbourne (Australia).
STABILITY OF HELICOPTER SLUNG LOADS
N. Matheson Aug. 1976 59 p refs
(ARL/AERO-Note-364) Copyright. Avail: Issuing Activity

Recent developments and data available concerning the operation of helicopters with slung loads are reviewed. In particular, slung load aerodynamic instabilities, vertical bounce, and sling leg flapping are considered. Methods for reducing these instabilities and procedures for extending the operating limits of a helicopter with different types of slung loads are discussed. Author

N78-16041 Arizona State Univ., Tempe.
SENSITIVITY ANALYSIS OF OPTIMAL FLIGHT TRAJECTORIES Ph.D. Thesis
Matthew Allison Nichols 1977 166 p
Avail: Univ. Microfilms Order No. 77-25887

Aircraft performance sensitivity to variations in aerodynamic and atmospheric conditions was analyzed. The energy state approximation was used to reduce the complexity of the aircraft equations of motion, permitting the use of optimizing functionals determined from variational techniques. The minimum time and minimum fuel trajectories were determined for the supersonic F-4 aircraft. Having determined the performance under nominal conditions, variations in aerodynamic terms and atmospheric conditions were introduced along the optimal trajectory. It was found that aircraft flight time and fuel consumption are sensitive to variations in aircraft thrust, drag coefficients, and weight. Furthermore, a hot day atmosphere increased ftlight time and fuel consumption while a cold day atmosphere reduced flight time and fuel consumption. Dissert. Abstr.

N78-16042*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GEMPAK: AN ARBITRARY AIRCRAFT GEOMETRY GENERATOR
Sharon H. Stack, Clyde L. W. Edwards, and William J. Small Dec. 1977 167 p refs
(NASA-TP-1022; L-11666) Avail: NTIS HC A08/MF A01 CSCL 01C

A computer program, GEMPAK, has been developed to aid in the generation of detailed configuration geometry. The program was written to allow the user as much flexibility as possible in his choices of configurations and the detail of description desired and at the same time keep input requirements and program turnaround and cost to a minimum. The program consists of routines that generate fuselage and planar-surface (winglike) geometry and a routine that will determine the true intersection of all components with the fuselage. This paper describes the methods by which the various geometries are generated and

provides input description with sample input and output. Also included are descriptions of the primary program variables and functions performed by the various routines. The FORTRAN program GEMPAK has been used extensively in conjunction with interfaces to several aerodynamic and plotting computer programs and has proven to be an effective aid in the preliminary design phase of aircraft configurations. Author

N78-16043*# Boeing Commercial Airplane Co., Seattle, Wash.
STUDY OF METALLIC STRUCTURAL DESIGN CONCEPTS FOR AN ARROW WING SUPERSONIC CRUISE CONFIGURATION Final Report, Tasks 1 and 2
M. J. Turner and D. L. Grande Dec. 1977 147 p refs
(Contract NAS1-12287)
(NASA-CR-2743; D6-42438-3) Avail: NTIS HC A07/MF A01 CSCL 01C

A structural design study was made, to assess the relative merits of various metallic structural concepts and materials for an advanced supersonic aircraft cruising at Mach 2.7. Preliminary studies were made to ensure compliance of the configuration with general design criteria, integrate the propulsion system with the airframe, select structural concepts and materials, and define an efficient structural arrangement. An advanced computerized structural design system was used, in conjunction with a relatively large, complex finite element model, for detailed analysis and sizing of structural members to satisfy strength and flutter criteria. A baseline aircraft design was developed for assessment of current technology. Criteria, analysis methods, and results are presented. The effect on design methods of using the computerized structural design system was appraised, and recommendations are presented concerning further development of design tools, development of materials and structural concepts, and research on basic technology. Author

N78-16044*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
CHARACTERIZATION OF NONGAUSSIAN ATMOSPHERIC TURBULENCE FOR PREDICTION OF AIRCRAFT RESPONSE STATISTICS Final Report
William D. Mark Dec. 1977 138 p refs
(Contract NAS1-14413)
(NASA-CR-2913; Rept-3496) Avail: NTIS HC A07/MF A01 CSCL 01C

Mathematical expressions were derived for the exceedance rates and probability density functions of aircraft response variables using a turbulence model that consists of a low frequency component plus a variance modulated Gaussian turbulence component. The functional form of experimentally observed concave exceedance curves was predicted theoretically, the strength of the concave contribution being governed by the coefficient of variation of the time fluctuating variance of the turbulence. Differences in the functional forms of response exeedance curves and probability densities also were shown to depend primarily on this same coefficient of variation. Criteria were established for the validity of the local stationary assumption that is required in the derivations of the exceedance curves and probability density functions. These criteria are shown to depend on the relative time scale of the fluctuations in the variance, the fluctuations in the turbulence itself, and on the nominal duration of the relevant aircraft impulse response function. Metrics that can be generated from turbulence recordings for testing the validity of the local stationary assumption were developed. Author

N78-16045*# Gates Learjet Corp., Wichita, Kans.
CONCEPTUAL DESIGN OF SINGLE TURBOFAN ENGINE POWERED LIGHT AIRCRAFT
F. Samuel Snyder, C. Gene Voorhees, Allyn M. Heinrich, and Donald N. Baisden Mar. 1977 174 p refs
(Contract NAS2-9242)
(NASA-CR-151972) Avail: NTIS HC A08/MF A01 CSCL 01C

The conceptual design of a four place single turbofan engine powered light aircraft was accomplished utilizing contemporary light aircraft conventional design techniques as a means of evaluating the NASA-Ames General Aviation Synthesis Program (GASP) as a preliminary design tool. In certain areas, disagreement or exclusion were found to exist between the results of the conventional design and GASP processes. Detail discussion of these points along with the associated contemporary design methodology are presented. Author

N78-16046*# Old Dominion Univ., Norfolk, Va. School of Engineering.
ANALYSIS OF SPREAD MULTI-JET VTOL AIRCRAFT IN HOVER Final Technical Report
Leroy F. Albang and A. Sidney Roberts Dec. 1974 89 p refs
(Contract NAS1-11707)
(NASA-CR-155582; TR-74-T8) Avail: NTIS HC A05/MF A01 CSCL 01C

An investigation of vertical takeoff and landing aircraft lift losses in hover was conducted to evaluate a method for a simplified test technique. Three flat plate models were tested to determine their usefulness in predicting hover characteristics by comparing results between plate and three-dimensional models. Data obtained for the plate models were correlated to three-dimensional results by the application of a geometrical equivalent height correction factor. The correlation of plate and tunnel models indicated that lift losses in ground effect were essentially independent of the efflux characteristics for the engine simulators. Author

N78-16047# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
QUIET PROPELLER/ROTOR CONCEPT EVALUATION Final Technical Report, 1 Feb. 1971 - 31 Oct. 1976
Paul A. Shahady, Craig A. Lyon, Matthew H. Chopin, Mark S. Ewing, and Robert M. McGregor Oct. 1977 185 p refs
(AD-A047297; AFAPL-TR-77-56) Avail: NTIS HC A09/MF A01 CSCL 01/3

This report describes an exploratory development program to experimentally evaluate the noise characteristics of several quiet propeller configurations to determine the noise reduction potential of various new designs. Variables investigated include number of blades, blade-to-hub phasing angles, and blade length. Performance and acoustic tests were conducted on modified UH-1D helicopter tail rotor blades in a specially designed hub. The hub allowed the spacing between each blade to be independently varied so that the effects of modulated blade spacing could be studied. The configurations tested included a 9.33 ft diameter six-bladed baseline rotor, the same rotor with 6% and 10% modulated blade spacing, a six-bladed rotor with leading edge rakes, a two-bladed rotor, and several rotor configurations with unequal blade lengths on the hub. Author (GRA)

N78-16048# RAND Corp., Santa Monica, Calif.
A CRITIQUE OF AIRCRAFT AIRFRAME COST MODELS Interim Report
J. P. Large and K. M. S. Gillespie Sep. 1977 63 p refs
(Contract F49620-77-C-0023)
(AD-A047181; R-2194-AF) Avail: NTIS HC A04/MF A01 CSCL 01/3

This document examines a sample of seven aircraft airframe cost models. The intent is to determine whether the model output is reasonable over a broad range of inputs, what limitations should be noted, and where one model might be preferable to the others. The critique shows that all the models have some deficiencies and all should be used with caution. The more recent models appear to be better than the older ones, which may be taken as a sign of progress, but it is plain that more progress is needed. Some of the lessons learned in this review may be helpful in pointing out how the next generation of aircraft airframe cost models could be improved. Author

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N78-16049# Boeing Aerospace Co., Seattle, Wash. Military Airplane Development.
SPECIFICATIONS FOR IDAMST SOFTWARE Final Technical

Report, Apr. - Jun. 1976
David G. Tubb Jul. 1977 130 p refs
(Contract F33615-76-C-1099)
(AD-A047163; AFAL-TR-76-208-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 09/2

The objective of this program was to define the operational flight program and operational test program for an Integrated Digital Avionics System for the Medium STOL (IDAMST) airplane. This effort is part of an Air Force Avionic Laboratory Program to specify a candidate avionics design based on DAIS technology. The approach involved the development of software requirements derived from the system analysis of the hardware baseline and the operational analysis of the AMST mission. The software requirements were developed into a specific IDAMST software design. The design is described in terms of functional, architectural, and configurational characteristics. The design documents consist of four Computer Program Development Specifications, type B5 per MIL-STD-490 and MIL-STD-483. The IDAMST software design was based on DAIS architecture and adapted as required to meet the IDAMST requirements. The DAIS architecture proved to be flexible allowing the design to be extended in IDAMST without major change. The IDAMST system defined satisfies the functional and operational requirements of the AMST. The design consists of a dual redundant processor with a reprogrammable backup processor. Author (GRA)

N78-16050# Transportation Systems Center, Cambridge, Mass.
GENERAL AVIATION AVIONICS STATISTICS: 1974 Annual Report, CY 1974
Judith C. Schwenk, ed. Aug. 1977 116 p refs
(AD-A045209; TSC-FAA-77-11; FAA-MS-77-2) Avail: NTIS HC A06/MF A01 CSCL 09/3

The primary objectives of this study were to (1) provide a framework for viewing the general aviation (GA) aircraft fleet, which would relate airborne avionics equipment to the capability for an aircraft to perform in the National Airspace System, and (2) within this framework, to portray the types of aircraft common to the GA fleet in terms of descriptive information on the aircraft. To provide the framework, capability groups of avionics equipment were designed and translated into aircraft capability to perform certain functions in the airspace system. Two types of groups evolved: hierarchical groups consist of avionics equipment meeting FAA requirements for flying in different airspace segments, in different conditions and for landing at different classes of airports; non-hierarchical groups consist of avionics equipment which give an aircraft additional capability, but which are not required equipment according to FAA regulations. Once the framework was developed, the GA fleet, as represented by the 1974 Aircraft Statistical Master File, was distributed among the capability groups, and its characteristics were studied. In addition, individual capability groups were analyzed to discover subgroups of aircraft with homogeneous characteristics. This report presents the methodologies used in the analyses, statistical tables and other results. Author (GRA)

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N78-16051*# National Aeronautics and Space Administration, Washington, D. C.
INVESTIGATION OF THE JET-WAKE FLOW OF A HIGHLY LOADED CENTRIFUGAL COMPRESSOR IMPELLER Doctoral Dissertation
Dietrich Eckardt Jan. 1978 194 p refs Transl. into ENGLISH from "Untersuchung der Strahl/Totwasserstromung hinter einem Hochbelasteten Radialverdichterlaufrad" (West-Germany), 1977 p 1-227 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original Doc. Prep. by Rhein Westfael Technical School, Aachen
(Contract NASw-2790)
(NASA-TM-75232) Avail: NTIS HC A09/MF A01 CSCL 21E

Investigations, aimed at developing a better understanding of the complex flow field in high performance centrifugal compressors were performed. Newly developed measuring techniques for unsteady static and total pressures as well as flow directions, and a digital data analysis system for fluctuating signals were thoroughly tested. The loss-affected mixing process of the distorted impeller discharge flow was investigated in detail, in the absolute and relative system, at impeller tip speeds up to 380 m/s. A theoretical analysis proved good coincidence of the test results with the DEAN-SENOO theory, which was extended to compressible flows. Author

N78-16052*# Fiber Science, Inc., Gardena, Calif.
FILAMENT-WINDING FABRICATION OF QCSEE CONFIGURATION FAN BLADES
Sam Yao Jan. 1978 22 p
(Contract NAS3-20099)
(NASA-CR-135332) Avail: NTIS HC A02/MF A01 CSCL 21E

The design and fabrication of twelve NASA-QCSEE type composite fan blades utilizing wet filament winding fabrication techniques is described. All composite fibers were continuous and attached to the root end. All components were formed, bonded, and co-cured in one molding process. Advanced fiber materials used in the blade fabrication were Thornel-300, Carbolon Z-2-1, and Carbolon Z-3 graphite in an epoxy resin matrix. Author

N78-16053*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
COLD-AIR PERFORMANCE OF FREE-POWER TURBINE DESIGNED FOR 112-KILOWATT AUTOMOTIVE GAS-TURBINE ENGINE. 1: DESIGN STATOR-VANE-CHORD SETTING ANGLE OF 35 DEG
Milton G. Kofskey and William J. Nusbaum Jan. 1978 23 p refs
(NASA-TP-1007; CONS/1011-12; E-8964) Avail: NTIS HC A02/MF A01 CSCL 21E

A cold air extperimental investigation of a free power turbine designed for a 112-kW automotive gas-turbine was made over a range of speeds from 0 to 130 percent of design equivalent speeds and over a range of pressure ratio from 1.11 to 2.45. Results are presented in terms of equivalent power, torque, mass flow, and efficiency for the design power point setting of the variable stator. Author

N78-16054*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
AN ANALYTICAL STUDY OF THERMAL BARRIER COATED FIRST STAGE BLADES IN A JT9D ENGINE
William R. Sevcik and Barry L. Stoner Jan. 1978 33 p refs (Contract NAS3-21033)
(NASA-CR-135360; PWA-5590) Avail: NTIS HC A03/MF A01 CSCL 21E

Steady state and transient heat transfer and structural calculations were completed to determine the coating and base alloy temperatures and strains. Results indicate potential for increased turbine life using thin durable thermal barrier coatings on turbine airfoils due to a significant reduction in blade average and maximum temperatures, and alloy strain range. An intepretation of the analytical results is compared to the experimental engine test data. Author

N78-16055*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
A REVIEW OF NASA'S PROPULSION PROGRAMS FOR AVIATION
Warner L. Stewart, Harry W. Johnson, and Richard J. Weber 1978 21 p refs Presented at the 16th Aerospace Sci. Meeting, Huntsville, Ala., 16-18 Jan.; sponsored by AIAA
(NASA-TM-73831) Avail. NTIS HC A02/MF A01 CSCL 21A

A review of five NASA engine-oriented propulsion programs of major importance to civil aviation are presented and discussed. Included are programs directed at exploring propulsion system concepts for (1) energy conservation subsonic aircraft (improved

current turbofans, advanced turbofans, and advanced turboprops); (2) supersonic cruise aircraft (variable cycle engines); (3) general aviation aircraft (improved reciprocating engines and small gas turbines); (4) powered lift aircraft (advanced turbofans); and (5) advanced rotorcraft. Author

N78-16056# Purdue Univ., Lafayette, Ind.
PROJECT SQUID Semiannual Progress Report, 1 Apr. - 30 Sep. 1977
T. C. Adamson, F. Browand, Edgar P. Bruce, Franklin Carta, and A. Dean 1 Oct. 1977 100 p refs Prepared by MIT, Cambridge
(Contract N00014-75-C-1143; Proj. SQUID)
(AD-A047076) Avail: NTIS HC A05/MF A01 CSCL 20/4

Progress on 20 research programs comprising Project SQUID are presented. The research programs fall into the areas of Aerodynamics and Turbomachinery, Combustion and Chemical Kinetics, Measurements and Turbulence. Project SQUID is a cooperative program of basic research related to jet propulsion. GRA

N78-16057# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A METHODOLOGY FOR ESTIMATING THE ECONOMIC BENEFITS OF AN AIRCRAFT ENGINE WARRANTY M.S. Thesis
Martin P. Dooley and Richard E. Kells Sep. 1977 135 p refs
(AD-A047282; AFIT-LSSR-10-77B) Avail: NTIS HC A07/MF A01 CSCL 14/1

Aircraft engine warranties are used extensively in the commercial airlines industry. If the Department of Defense hopes to use warranties as a method of reducing engine life cycle costs, the costs and benefits of each warranty must be carefully analyzed. The methodology developed in this study provides framework to assist analysts in estimating the economic benefits of an engine warranty. A test application of the methodology details the benefits of a hypothetical DOD engine warranty, and includes a sensitivity analysis of the key variables. The study concludes that the basic method can be used to estimate the economic benefits of a wide range of engine and equipment warranties. Author (GRA)

N78-16058# Strategic Air Command, Offutt AFB, Nebr. Aircraft Engineering Div.
TF-30-P-7 INSTALLED TRIM CORRECTION Engineering Report, Aug. 1973 - Jan. 1977
James L. Pettigrew 14 Jan. 1977 70 p refs
(AD-A047023; SAC/LGME-ER-P-206) Avail: NTIS HC A05/MF A01 CSCL 21/5

This report summarizes the findings from engineering tests conducted to determine causes of observed TF30-P-7 engine performance shift during operation of the FB-111A aircraft. Details of the test conducted at Pease AFB during September 1974 are given along with analysis of the data by P/WA, GD/FW, and Hq SAC/LGME. Measurement of ambient temperature, instrument uncertainty in the trim procedure, and assumption of constant inlet operation for simplification were found to be the prime causes of the apparent performance or trim shift. Recommendations for improvement are given. Author (GRA)

N78-16059# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
PHYSICAL ANALYSIS OF THE IMPULSIVE ASPECTS OF HELICOPTER NOISE Final Report
William J. Galloway Apr. 1977 394 p refs
(Contract WI-77-3683-1)
(AD-A039715; BBN-3425; FAA-EQ-77-8) Avail: NTIS HC A17/MF A01 CSCL 01/3

An evaluation is made of several helicopter flyover noise calculation schemes intended to describe signal impulsive character. These schemes were proposed by ICAO member organizations. Data are presented for various recorded flyovers and for simulations of helicopter flyovers. Author (GRA)

N78-16060# Southern Methodist Univ., Dallas, Tex. Dept. of Electrical Engineering.
MODELING AND ANALYSIS OF AIRBORNE POWER UNIT CONTROLS Final Report
S. C. Gupta, K. R. Thompson, and R. Billa May 1977 114 p (Contract F29601-75-C-0071)
(AD-A041373; AFWL-TR-76-307) Avail: NTIS HC A06/MF A01 CSCL 10/2

This report models and analyzes the controls for an airborne power unit. It consists of a fuel supply system, a gas generator, and a turbine alternator, which were modeled. Both analog and digital controls were developed for both the nonlinear model and the optimum linear model. Author (GRA)

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N78-16061 Stanford Univ., Calif.
UNSTEADY AERODYNAMIC MODELING AND ACTIVE AEROELASTIC CONTROL Ph.D. Thesis
John William Edwards 1977 209 p
Avail: Univ. Microfilms Order No. 77-25659

Unsteady aerodynamic modeling techniques are developed and applied to the study of active control of elastic vehicles. The problem of active control of a super-critical flutter mode poses a definite design goal--stability, and is treated in detail. The transfer functions relating the arbitrary airfoil motions to the airloads are derived from the Laplace transforms of the linearized airload expressions for incompressible two-dimensional flow. The transfer function relating the motions to the circulatory part of these loads is recognized as the Theodorsen function extended to complex values of reduced frequency, and is termed the generalized Theodorsen function. A brief critique of previous attempts to generalize the Theodorsen function is given. Inversion of the Laplace transforms yields exact transient airloads and airfoils motions. Exact root loci of aero-elastic modes are calculated, providing quantitative information regarding subcritical and supercritical flutter conditions. Dissert. Abstr.

N78-16062*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AERODYNAMIC CHARACTERISTICS OF AN F-8 AIRCRAFT CONFIGURATION WITH A VARIABLE CAMBER WING AT MACH NUMBERS FROM 1.5 TO 2.0
Frederick W. Boltz Dec. 1977 70 p
(NASA-TM-73271; A-7141) Avail: NTIS HC A04/MF A01 CSCL 01C

A 0.1-scale model of an F-8 aircraft was tested over a range of Mach numbers from 1.5 to 2.0. Reynolds number of 4.12 million was based on wing mean-aerodynamic chord for angles of attack varying from -2 deg to +12 deg. The model was equipped with an advanced-technology-conformal-variable-camber wing (ATCVCW) having simple hinge flaps. Data were also obtained for the model equipped with the basic F-8 wing and conventional flaps. Model variables included aileron and wing trailing edge deflections and horizontal tail incidence. The ATCVCW configuration produced slight improvements in lift-curve slope, drag, and static longitudinal stability over that of the basic F-8 wing configuration. Flap effectiveness was essentially the same for both wings. Author

N78-16063*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STUDY OF THE APPLICATION OF AN IMPLICIT MODEL-FOLLOWING FLIGHT CONTROLLER TO LIFT-FAN VTOL AIRCRAFT
Vernon K. Merrick Nov. 1977 180 p refs
(NASA-TP-1040; A-6712) Avail: NTIS HC A09/MF A01 CSCL 01C

An implicit model-following flight controller is proposed. This controller is relatively simple in concept: it provides an input/output relationship that is approximately that of any selected second order system; it provides good gust alleviation; and it is self-trimming. The flight controller was applied to all axes of a comprehensive mathematical model of a lift-fan V/STOL transport. Power management controls and displays were designed to match

the various modes of control provided by the flight controller. A piloted simulation was performed using a six degree of freedom simulator. The fixed-operating-point handling qualities throughout the powered lift flight envelope received pilot ratings of 3-1/2 or better. Approaches and vertical landings in IFR zero-zero conditions received pilot ratings varying from 2-1/2 to 4 depending on the type of approach and weather conditions. Author

N78-16064*# Colorado Univ., Boulder.
DESIGN OF NONINTERACTING FLIGHT CONTROL SYSTEMS IN THE PRESENCE OF LARGE PARAMETER VARIATIONS Final Report, 1 Jul. 1975 - 30 Nov. 1977
Frank S. Barnes Nov. 1977 86 p refs
(Grant NsG-1213)
(NASA-CR-155589) Avail: NTIS HC A05/MF A01 CSCL 01C

The effects of system parameter variations on the over-all system stability were considered. Results from the application of numerical minimization to reduce system coupling are given and some future research directions are outlined. Author

N78-16065# Dynamic Controls, Inc., Dayton, Ohio.
RESEARCH AND DEVELOPMENT OF AIRCRAFT CONTROL ACTUATION SYSTEMS. THE DEVELOPMENT OF A DIRECT DRIVE FLY-BY-WIRE FLIGHT CONTROL SYSTEM AND EVALUATION OF A FORCE SHARING FLY-BY-WIRE ACTUATOR Final Report, Feb. 1975 - Jun. 1977
Gavin D. Jenney Sep. 1977 216 p
(Contract F33615-75-C-3068)
(AD-A047283; AFFDL-TR-77-91) Avail: NTIS HC A10/MF A01 CSCL 01/4

This report describes the design and test evaluation of a direct drive fly-by-wire redundant control system. Also included in the report is the evaluation testing of a fly-by-wire tandem actuator mechanization developed by Parker-Hannifin Aerospace Hydraulics Division, Irvine California. The direct drive system is based on using moving coil force motors to position a hydraulic control valve without hydraulic amplification. The system is designed as a single fail operate system which will accept one input or component failure and continue to operate with acceptable performance. The test results verified that the failure modes and performance met the design goals. The system incorporates component dispersion techniques to allow single hit survivability. The direct drive mechanization offers adequate performance with minimum complexity as a fly-by-wire control system. The Parker-Hannifin actuator mechanization is a two fail operate configuration using an integrated secondary actuator with both force and position summing. The test results document the operational characteristics of the design. Author (GRA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N78-16066*# Douglas Aircraft Co., Inc., Long Beach, Calif.
EXPANSION OF FLIGHT SIMULATOR CAPABILITY FOR STUDY AND SOLUTION OF AIRCRAFT DIRECTIONAL CONTROL PROBLEMS ON RUNWAYS, APPENDIXES
J. A. McGowan 20 Jan. 1978 224 p refs
(Contract NAS1-13981)
(NASA-CR-145281) Avail: NTIS HC A10/MF A01 CSCL 14B

The models used to implement the DC-9-10 aircraft simulation for the Runway Direction Control study are presented. The study was done on the Douglas Aircraft six-degree-of-freedom motion simulator. Documentation of the models was in algebraic form, to the extent possible. Effort was directed toward presenting what was actually done rather than general forms. Author

N78-16067# SRI International Corp., Menlo Park, Calif. All Weather Landing Systems.
PILOTED FLIGHT SIMULATOR STUDY OF LOW-LEVEL WIND SHEAR, PHASE 2 Interim Report, Aug. 1976 - Mar. 1977
W. B. Gartner, D. W. Ellis, W. H. Foy, M. G. Keenan, A. C. McTee, and W. O. Nice Mar. 1977 189 p refs
(AD-A047251; FAA-RD-77-157) Avail: NTIS HC A09/MF A01 CSCL 01/3

Task 2 of the All-Weather Landing Systems project is concerned with piloted flight simulation tests of various techniques designed to aid the pilot to detect and cope with low level wind shear on approach and landing. The operational situation of a DC-10 aircraft landing in Category 1 visibility with ILS guidance was simulated. Wind corresponding to inversion-layer, frontal, thunderstorm and no-shear conditions were simulated to provide test profiles. The baseline aiding concept was the conventional DC-10 manual approach management. The aiding concepts tested were based on ground speed displays (first experiment), flight path angle (second), and modified (acceleration-augmented) flight director (third experiment). Author

N78-16068# Naval Civil Engineering Lab., Port Hueneme, Calif.
EXPERIMENTAL RELATIONSHIPS BETWEEN MODULI FOR SOIL LAYERS BENEATH CONCRETE PAVEMENTS Final Report, Jun. 1975 - Jan. 1976
J. B. Forrest, P. S. Springston, M. G. Katona, and J. Rollins Jun. 1977 245 p refs
(Contract DOT-FA74WAI-487)
(AD-A046239/0; FAA-RD-76-206) Avail: NTIS HC A11/MF A01 CSCL 01/5

Two subgrades and four rigid pavement test sections were constructed and instrumented to recover experimental information of soil/rigid pavement behavior static loadings. Pavement deflections and pavement/soil strain data were recorded for incremental static loads applied to a 30 inch diameter steel plate. Tests were conducted for comparison of experimentally collected data with Westergaard and elastic layer analyses of the test sections to investigate whether a consistent mathematical relationship exists between the two methods of analysis. To this end, material characterizations were carried out for the component materials in the four different pavement sections and analytically predicted and experimentally obtained response data were compared. Author

N78-16069# Naval Postgraduate School, Monterey, Calif.
EVALUATION OF AND OPERATIONAL PROCEDURES FOR A HELICOPTER SIMULATION SYSTEM UTILIZING AN INTEGRATED ELECTRONIC INSTRUMENT DISPLAY M.S. Thesis
William Woodrow Fetzer, Jr. Jun. 1977 89 p refs
(AD-A047166) Avail: NTIS HC A05/MF A01 CSCL 01/4

This report discusses the evaluation and documentation of an integrated electronic instrument display designed to investigate stability and control of a helicopter during precision hover operations. The equations of motion, developed from the Kaman SH-2F Seasprite helicopter, were implemented by a hybrid computer system and displayed by a graphics processor. A complete procedural checklist, including troubleshooting methods, is included in this report. This helicopter simulation system can be used for further research in the development of optimal heads-up display configurations as well as analyses of instability caused by pilot induced oscillations in the hover flight regime. Author (GRA)

N78-16070# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
AN ASSESSMENT OF RELEVANT DECISION MAKING FACTORS FOR ORGANIC VERSUS CONTRACT MAINTENANCE OPTIONS ON USAF FLIGHT SIMULATORS M.S. Thesis
Ronald J. Arceneaux and George E. Farsshman, Jr. Sep. 1977 137 p refs
(AD-A047136; AFIT-LSSR-7-77B) Avail: NTIS HC A07/MF A01 CSCL 05/1

Since the maintenance on flight simulators is reportably manpower intensive, the use of contract maintenance is often suggested. A taxonomy of relevant decision making factors was

not available for the maintenance manager's use when evaluating the alternatives of contracting for maintenance or maintaining an organic capability. This research effort has identified some relevant decision making factors for a maintenance manager to consider when addressing the issue of contract maintenance versus organic maintenance at the organizational and intermediate level. The data were obtained from open-end interviews on which an analysis was performed utilizing a technique of behavioral research called semantic content analysis. The data analysis allowed for a determination of the relevant decision making factors and the subsequent recommendations on the development of a contract maintenance decision tree network. Basically, this decision tree would allow a manager to evaluate the options of contract maintenance versus organic maintenance, making a determination of which is optimal for the given situation. The factors identified by this research are considered to be cost drivers of the applicable maintenance option. Author (GRA)

N78-16071# Naval Postgraduate School, Monterey, Calif.
AN EVALUATION OF THE FIDELITY OF MOTION SIMULATORS USING A MODEL OF HUMAN DYNAMIC ORIENTATION M.S. Thesis
Richard G. Fuller Sep. 1977 94 p refs
(AD-A047120) Avail: NTIS HC A05/MF A01 CSCL 06/16

A deterministic simulation using a model of human dynamic orientation was written to optimize the parameters of the motion base control system for a six-degree-of-freedom flight simulator. An experiment requiring pilots to rate different levels of motion fidelity during a basic flight task provided a data base for validation of the simulation. Ratings between subjects for linear, rotational, and combined motion cues were inconsistent due, in part, to the subjects' lack of experience in the F-15 aircraft and proficiency in high performance aircraft. The coefficient of concordance among subjects for the three ratings were .4483, .4835, and .5914, respectively. Comparison of simulation results with experimental data yielded positive correlations as high as .5138. Response of the simulation to changing wash-out filter parameters was investigated and found to be adaptable to experimental optimization methods. Author (GRA)

N78-16072# Calspan Corp., Buffalo, N. Y.
WIND TUNNEL MODEL STUDY OF THE HOT EXHAUST PLUME FROM THE COMPRESSOR RESEARCH FACILITY AT WRIGHT-PATTERSON AIR FORCE BASE, OHIO Final Report, May 1976 - Jun. 1977
Gary R. Ludwig Oct. 1977 59 p refs
(Contract F33615-76-C-2092)
(AD-A047205; CALSPAN-XE-5933-A-101; AFAPL-TR-77-58) Avail: NTIS HC A04/MF A01 CSCL 13/2

This report presents the results of a wind tunnel model study to determine temperatures at various locations generated by the hot exhaust air from the Compressor Research Facility (CRF) which is being built at Wright-Patterson Air Force Base, Ohio. The study was designed to provide data at the inlet to the CRF and at other nearby locations where pedestrians, building ventilation systems, and vegetation might be affected. The test program, which was conducted in the Calspan Atmospheric Simulation Facility, included flow visualization studies and quantitative concentration measurements of a tracer gas from which full-scale temperatures could be calculated. The concentration measurements were performed for a number of wind speeds at each of twelve different wind directions. Two exhaust flows and two exhaust stack configurations were studied. Author (GRA)

N78-16073# Naval Research Lab., Washington, D. C.
DESIGN STUDY OF A CENTERPLATE MOUNT FOR WIND TUNNEL MODELS M.S. Thesis
Robert Wayne Russell Jun. 1977 114 p refs
(AD-A047204) Avail: NTIS HC A06/MF A01 CSCL 14/2

A three-strut wind-tunnel model support system was being used with an electrical balance in the 3.5 by 5.0 foot Department of Aeronautics low-speed wind tunnel. The traditional method of image systems and alternate inverted mounting for the evaluation of aerodynamic tares was considered impractical for implementation in the small sized tunnel. The design and installation of an alternate model support system using a centerplate mount was accomplished. An aerodynamic evaluation for comparing the two model mounting concepts was performed via experiments with a single calibration wing. Additionally, these experiments were the first operational exercise of a recently developed microprocessor data acquisition system. Author (GRA)

N78-16074# Federal Aviation Administration, Washington, D. C. Office of Aviation System Plans.
REMOTENESS-COMPENSATION METHODOLOGY FOR BENEFIT/COST ESTABLISHMENT AND DISCONTINUANCE CRITERIA Final Report
Jan. 1977 55 p
(AD-A043836; FAA-ASP-76-7) Avail: NTIS HC A04/MF A01 CSCL 01/5

This report develops a procedure for adjusting the benefit/cost (B/C) ratios by which proposals for FAA terminal facilities in remote locations are evaluated. The procedure is applicable to the types of installations for which B/C analyses, based on nationwide average data, are incorporated in Airway Planning Standard Number One (FAA Order 7031.2B). Without such an adjustment, proposals for facilities in Alaska and other such locations could not realistically be compared with those for facilities in the contiguous 48 states (CONUS). The compensatory methodology first adjusts construction and installation costs according to a geographically differentiated index. Staff housing cost is subtracted. Exceptional site-preparation and other cost elements are not discarded, but their cost is made equivalent to the cost of doing the same work at a corresponding CONUS site. Next, for facilities to serve remote communities shown to be exceptionally reliant on air transportation, the ascribed benefits are adjusted upward. This benefit enhancement is proportional to the communities: aviation-dependency as determined by the model contained in this report, but it is not permitted to more than double intrinsic benefits. The benefit-enhancement premium is earned by a relatively few sites where large numbers of citizens are without alternative transportation links to the outside world for extended periods. Author (GRA)

N78-16075# Federal Aviation Administration, Washington, D. C. Office of Aviation System Plans.
ESTABLISHMENT OF NEW MAJOR PUBLIC AIRPORTS IN THE UNITED STATES
Aug. 1977 140 p
(AD-A046462; FAA-ASP-77-3) Avail: NTIS HC A07/MF A01 CSCL 01/5

This study was performed in response to Section 26(2) of the Airport and Airway Development Act Amendments of 1976 (Public Law 94-353) which directed the Secretary of Transportation to conduct a study on the establishment of a new major public airports in the United States, including (a) identifying potential locations, (b) evaluating such locations, and (c) investigating alternative methods of financing the land acquisition and development costs necessary for such establishment. The report assesses needs for major new airports in the United States through the year 2000. Potential airport locations, the general size requirements of new airports, financing, and airport development issues and problems are also analyzed under a variety of future conditions. The potential need for new major airports is highly sensitive to the future forecasted activity, extent of accommodation of general aviation, effectiveness of the upgraded third generation air traffic control system in increasing capacity, and peak spreading, in that order. Author (GRA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N78-16076*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTERACTION OF LARGE, HIGH POWER SYSTEMS WITH OPERATIONAL ORBIT CHARGED PARTICLE ENVIRONMENTS
Carolyn K. Purvis, N. John Stevens, and Frank D. Berkopec 1977 19 p refs Presented at the Meeting on Long Range Planning for the Ind. Phase of Space Exploration, San Francisco, 18-20 Oct. 1977; Sponsored by the Am. Astronautical Soc.

(NASA-TM-73867; E-9459) Avail: NTIS HC A02/MF A01 CSCL 22A

A potentially hazardous spacecraft environment interaction is discussed. The interaction of large high voltage systems with low energy (less than 50 eV) plasmas which can result in loss of power and/or arching was examined. The impact of this class of interactions where the ambient operation is most severe at low orbits where the ambient plasmas are densest. Results of experimental work and predictions of simple analytical models were presented and their implications for design of space systems were reviewed. Author

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N78-16077# Range Commanders Council, White Sands Missile Range, N. Mex. Range Safety Group.
STATUS OF RANGE SAFETY FILTER SYSTEMS Final Report
Oct. 1977 119 p refs Supersedes IRMFSG-309-71
(AD-A047024; RSG-309-77; IRMFSG-309-71) Avail: NTIS HC A06 MF A01 CSCL 16/1

The goal of range safety is the prevention of injury to personnel or damage to property by taking all reasonable precautions consistent with operational requirements. This is dependent not only on precautions taken in the preparation of a missile or vehicle launch, but in the ability of the Range Safety Officer to maintain surveillance during flight to ensure compliance with established safety criteria. To maintain this necessary surveillance, the RSO must have at his disposal information depicting performance of the missile and possible impact locations for comparison against predetermined destruct criteria as well as assurance that his entire safety system is in operational condition at all times. Presenting this information in a manner that allows clear and quick understanding of significant data will vary due to missile dynamics and test range geometry. Therefore, there is no one-best filter for all applications. A survey of seven of the test ranges represented in the RSG of the RCC was made to determine the type of filter systems currently in use at the various ranges. This information is presented in this document as an aid to all ranges in determining which systems may have merit for their application and to provide some insight into future applications of filter systems. Author (GRA)

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N78-16078* American Geophysical Union, Washington, D.C.
SCIENTIFIC RESULTS OF THE VIKING PROJECT
1977 714 p refs Original contains color illustrations
(NASA-CR-155560; ISBN-0-87590-207-3; LC-77-23719) Copyright. Avail: Issuing Activity, $30.00 CSCL 22A

A total of 50 papers are presented on various aspects of the Viking Program and exploration of the planet Mars. Viking orbiter and lander imaging is included along with discussions of infrared thermal mapping, atmospheric water detection, meteorology and seismology. B.L.P.

N78-16079 Ohio State Univ., Columbus.
NON-LINEAR ANALYSIS OF SPACE LAUNCH VEHICLE POGO OSCILLATIONS Ph.D. Thesis
Donald Stuart Edgecombe 1977 95 p
Avail: Univ. Microfilms Order No. 77-24622

The feasibility and effects of including nonlinearities in open-loop analysis of launch vehicle POGO oscillations was examined. The specific test case considered was the oscillation of a Titan 2 missile. A non-linear analysis using describing functions to represent fluid flow nonlinearities and including nonlinear fuel and oxidizer pump characteristics was conducted. The non-linear analysis gave improved predictions of the time of POGO oscillation onset and stopping as compared with a linear analysis using linear differential equations. Estimates of the frequency and magnitude of the oscillations are provided. The correlation between observed and predicted oscillation frequency and magnitude improves as additional nonlinearities are included in the analysis. For the vehicle model used, the most significant sources of nonlinearity were the oxidizer feed lines and the propellant pumps. Dissert. Abstr.

N78-16080 Virginia Polytechnic Inst. and State Univ., Blacksburg.
DYNAMICS OF SPINNING FLEXIBLE SATELLITES Ph.D. Thesis
Ching-Pyng Chang 1977 111 p
Avail: Univ. Microfilms Order No. 77-20227

The dynamic characteristics and stability of a spinning rigid body with a number of flexible parts are investigated. The system is hybrid in the sense that it is described by coordinates depending on time alone and coordinates depending on spatial position and time. The method was applied to the simplified model of the European Space Agency's GEOS spacecraft to obtain explicit forms of the equations of motion and stability criteria in terms of system parameters. It was found that the motion about the equilibrium is stable but the fundamental frequency is lower than the spin rate. As a by-product, it is shown that neglecting the motion of the mass center is immaterial as far as the stability is concerned, except in the case in which the points of attachment of the flexible parts are off-set along the spin axis relative to the mass center of the spacecraft. In the later case, the effect of the motion of the mass center must be examined carefully. Dissert. Abstr.

N78-16081*# Sheldahl Co., Northfield, Minn.
PRELIMINARY SOLAR SAIL DESIGN AND FABRICATION ASSESSMENT: SPINNING SAIL BLADE, SQUARE SAIL SHEET Final Report
J. B. Daniels, D. M. Dowdle, D. W. Hahn, E. N. Hildreth, D. R. Lagerquist, E. J. Mahagnoul, J. B. Munson, and T. F. Origer 22 Jun. 1977 151 p Prepared for JPL
(Contracts NAS7-100; JPL-954721)
(NASA-CR-155591) Avail: NTIS HC A08/MF A01 CSCL 22B

The designs and fabrication methods, equipment, facilities, economics, and schedules, for the square sail sheet alternate are evaluated. The baseline for the spinning sail blade design and related fabrication issues are assessed. Author

N78-16082# Martin Marietta Aerospace, Denver, Colo.
SATELLITE ENGAGEMENT SCENARIOS MODEL Final Report
Darrell Roos 1 Nov. 1977 19 p refs
(Contract F04701-77-C-0066)
(AD-A047182; MCR-77-555) Avail: NTIS HC A02/MF A01 CSCL 15/7

This report documents the design of the following 4 potential additions to the SES software system: Window Finder output analyzer; Window Finder output merger; ECM/ECCM model; and OCM/OCCM model. GRA

N78-16083# Rockwell International Corp., Thousand Oaks, Calif. Science Center.

THE 1.06 MICROMETER AVALANCHE PHOTODIODE DETECTOR Final Report, 3 Dec. 1973 - 4 Aug. 1975
Richard C. Eden Apr. 1977 270 p refs
(Contract F33615-74-C-1030)
(AD-A041224; SC571.16TRF; AFAL-TR-76-74) Avail: NTIS HC A12/MF A01 CSCL 09/1

Satellite laser communications at gigabit data rates based on the Nd YAG laser are of great interest to the Air Force. The development of a complete solid state 1.06 micrometers optical receiver which can be used in optical communications at data rates approaching 1.5 Gb/s or in other applications requiring sensitive, short pulse detection is described. Both the development of a type of heterojunction three thru five semiconductor alloy avalanche photodiode and extremely charge sensitive wideband low noise preamp design, making use of GaAs Schottky barrier gate field effect transistors (GAASFET'S) operating in the negative feedback 'transimpedance' model were examined. The inverted homo-heterojunction GaAs (1-x)Sb(x) avalanche photodiodes developed 1.06 micrometers quantum efficiencies over 96%, and for typical 3 mil diameter devices, have bulk leakages of about 300 pA, total leakages of about 3nA at -50 volts bias. Author (GRA)

N78-16084# General Accounting Office, Washington, D. C. Procurement and Systems Acquisition Div.
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION SHOULD PROVIDE THE CONGRESS WITH MORE INFORMATION ON THE PIONEER VENUS PROJECT
7 Nov. 1977 55 p
(PB-273573/6; PSAD-77-65) Avail: NTIS HC A04/MF A01 CSCL 22A

NASA will launch two Pioneer spacecraft in 1978 to get information on Earth's closest neighbor, Venus. These missions will be the latest in a series of U.S. Venus flights which began in 1961. Costs have grown and technical problems have cropped up in the project. NASA's quality assurance policy has not been applied in this program. Efforts at international cooperation in exploring Venus should be continued. Improvements can be made in the financial and management information being provided to the Congress. GRA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N78-16085*# Battelle Columbus Labs., Ohio.
STS PILOT USER DEVELOPMENT PROGRAM Final Report
J. R. McDowell 30 Mar. 1977 114 p refs
(Contract NASw-2964)
(NASA-CR-155571) Avail: NTIS HC A06/MF A01 CSCL 22A

Full exploitation of the STS capabilities will be not only dependent on the extensive use of the STS for known space applications and research, but also on new, innovative ideas of use originating with both current and new users. In recognition of this, NASA has been engaged in a User Development Program for the STS. The program began with four small studies. Each study addressed a separate sector of potential new users to identify techniques and methodologies for user development. The collective results established that a user development function was not only feasible, but necessary for NASA to realize the full potential of the STS. This final report begins with a description of the overall pilot program plan, which involved five specific tasks defined in the contract Statement of Work. Each task is then discussed separately; but two subjects, the development of principal investigators and space processing users, are discussed separately for improved continuity of thought. These discussions are followed by a summary of the primary results and conclusions of the Pilot User Development Program. Specific recommendations of the study are given. Author

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N78-16086# Federal Electric Corp., Vandenberg AFB, Calif.
AM/AGC COMBINER Final Report, 20 Sep. 1976 - 10 Feb. 1977
V. Shibata 10 Feb. 1977 170 p refs
(Contract F04701-72-C-0203)
(AD-A041505; SAMTEC-TR-77-35) Avail: NTIS HC A08/MF A01 CSCL 09/6

This report presents test results and operational launch support data used to compare the performance of a standard AGC controlled combiner to the performance of a prototype combiner unit which features AM (a quick response envelope detector) and AGC control. Results of test data and launch data indicate that the PMTC 'COMB/SEL' combiner with the low pass filter removed from the control circuit provided the best data recovery under launch conditions. Author (GRA)

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics.*

N78-16087 Pennsylvania State Univ., University Park.
CONTROL OF A SYNCHRONOUS SATELLITE WITH LARGE FLEXIBLE ARRAYS USING A DOUBLE GIMBALED MOMENTUM WHEEL Ph.D. Thesis
Stanley Eugene Hillard 1977 253 p
Avail: Univ. Microfilms Order No. 77-23237

A symmetric vehicle possessing two large, highly flexible solar wings in synchronous orbit is discussed. Each wing is comprised of a solar cell blanket, rigid tip piece, and flexible support boom. The linearized satellite attitude equations are derived using a hybrid coordinate scheme along with ancillary flexible array component relations and their applicable boundary conditions. Continuous deformation coordinates are expressed in terms of normal modes while vehicle attitude perturbations are expressed using Euler angles. The uncontrolled vehicle natural frequencies are determined and the effects of inertial, material, and geometrical parameters calculated. Acceptable control laws are presented and attitude control transfer functions are determined. Criteria are established for system stability and satisfactory response, using classified methods of control system analysis. Dissert. Abstr.

N78-16088*# Exotech Research and Analysis, Inc., Gaithersburg, Md.
POST VIKING PLANETARY PROTECTION REQUIREMENTS STUDY Final Report
Robert P. Wolfson 31 Aug. 1977 34 p Sponsored by NASA Prepared for JPL
(Contract JPL-954807)
(NASA-CR-155585) Avail: NTIS HC A03/MF A01 CSCL 22B

Past planetary quarantine requirements were reviewed in the light of present Viking data to determine the steps necessary to prevent contamination of the Martian surface on future missions. The currently used term planetary protection reflects a broader scope of understanding of the problems involved. Various methods of preventing contamination are discussed in relation to proposed projects, specifically the 1984 Rover Mission. P.R.A.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N78-16089*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LIQUID ROCKET LINES, BELLOWS, FLEXIBLE HOSES, AND FILTERS NASA Space Vehicle Design Criteria (Chemical Propulsion)
Apr. 1977 186 p refs Prepared by Rocketdyne, Canoga Park, Calif.
(NASA-SP-8123) Avail: NTIS HC A09/MF A01 CSCL 21H

Fluid-flow components in a liquid propellant rocket engine and the rocket vehicle which it propels are interconnected by lines, bellows, and flexible hoses. Elements involved in the successful design of these components are identified and current technologies pertaining to these elements are reviewed, assessed, and summarized to provide a technology base for a checklist of rules to be followed by project managers in guiding a design or assessing its adequacy. Recommended procedures for satisfying each of the design criteria are included. A.R.H.

N78-16090*# Hughes Research Labs., Malibu, Calif.
EXTENDED PERFORMANCE SOLAR ELECTRIC PROPULSION THRUST SYSTEM STUDY. VOLUME 4: THRUSTER TECHNOLOGY EVALUATION Final Report, 14 Feb. - 29 Aug. 1977
R. L. Poeschel, E. I. Hawthorne, Y. C. Weisman, M. Frisman, G. C. Benson, R. J. McGrath, R. M. Martinelli, T. L. Linsenbardt, and J. R. Beattie Sep. 1977 110 p refs Prepared in cooperation with Hughes Space and Communications Group, Los Angeles (Contract NAS3-20395)
(NASA-CR-135281) Avail: NTIS HC A06/MF A01 CSCL 21C

Several thrust system design concepts were evaluated and compared using the specifications of the most advanced 30 cm engineering model thruster as the technology base. Emphasis was placed on relatively high power missions (60 to 100 kW) such as a Halley's comet rendezvous. The extensions in thruster performance required for the Halley's comet mission were defined and alternative thrust system concepts were designed in sufficient detail for comparing mass, efficiency, reliability, structure, and thermal characteristics. Confirmation testing and analysis of thruster and power processing components were performed, and the feasibility of satisfying extended performance requirements was verified. A baseline design was selected from the alternatives considered, and the design analysis and documentation were refined. The baseline thrust system design features modular construction, conventional power processing, and a concentrator solar array concept and is designed to interface with the Space Shuttle. Author

N78-16091# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF THE COMBUSTION BEHAVIOR OF SOLID FUEL RAMJETS
C. J. Mady, P. J. Hickey, and P. J. Netzer Sep. 1977 47 p refs Backup document for AIAA Synoptic, "Combustion Behavior of Solid Fuel Ramjets", scheduled for publication in Journal of Spacecraft and Rockets in May-Jun. 1978
(AD-A048411; NPS-67NT77092) Avail: NTIS HC A03/MF A01 CSCL 21/4

An experimental and analytical investigation was conducted of the combustion behavior in solid fuel ramjets. The effects of configuration variables on combustion performance were experimentally determined. Air ducting methods were found to affect combustion efficiency through fuel port flow rates, bypass dump momentum and geometry and bypass ratio. Bypass configurations with plexiglas fuel altered the heat transfer mechanisms within the port and decreased combustion efficiency. The analytical model was found to be in qualitative agreement with experimental data. Author

N78-16092# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
PULSED MAVERICK TESTING Final Report, Dec. 1975 - May 1976
Jack E. Hewes and Jack J. Donn Nov. 1977 26 p refs (AF Proj. 319A)
(AD-A047014; AFRPL-TR-77-60) Avail: NTTIS HC A03/MF A01 CSCL 21/8

This program was conducted to determine the combustion stability of the Maverick motor. This report details the testing performed, the data analysis and conclusions. Author (GRA)

N78-16093# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab Section.
MINUTEMAN STAGE I MOTOR RELIABILITY IMPROVEMENT PROGRAM SURVEILLANCE Final RIP Report
John A. Thompson Oct. 1977 28 p
(AD-A047272; MANCP-379(77)) Avail: NTIS HC A03/MF A01 CSCL 21/8

In this report, Thiokol's data with the data from four years of testing in MANCP's laboratory were combined and regression analyses made by MANCP's statistical group. The purpose of testing is to provide early warning if any serious degradation trends occur in the components being evaluated. The regressions show little or no change in trends from those previously established and are in good agreement with TWR-7300 data. Therefore, based on this analysis the service life of these components may be extended for at least two years beyond the last data point. This constitutes final reporting on the laboratory testing program on component materials from the RIP Surveillance Program. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N78-16094*# Gelles (S. H.) Associates, Columbus, Ohio.
MATERIALS SCIENCE EXPERIMENTS IN SPACE Final Report
S. H. Gelles, B. C. Giessen, M. E. Glicksman, J. L. Margrave, H. Markovitz, A. S. Nowick, J. D. Verhoeven, and A. F. Witt Jan. 1978 84 p refs
(Contract NAS3-20049)
(NASA-CR-2842) Avail: NTIS HC A05/MF A01 CSCL 22A

The criteria for the selection of the experimental areas and individual experiments were that the experiment or area must make a meaningful contribution to the field of material science and that the space environment was either an absolute requirement for the successful execution of the experiment or that the experiment can be more economically or more conveniently performed in space. A number of experimental areas and individual experiments were recommended for further consideration as space experiments. Areas not considered to be fruitful and others needing additional analysis in order to determine their suitability for conduct in space are also listed. Recommendations were made concerning the manner in which these materials science experiments are carried out and the related studies that should be pursued. Author

N78-16095*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

TOXICITY OF PYROLYSIS GASES FROM WOOD

Carlos J. Hilado (San Francisco Univ.), Nancy V. Huttlinger (San Francisco Univ.), Briget A. Oneill (San Francisco Univ.), Demetrius A. Kourtides, and John A. Parker Dec. 1977 19 p refs
(NASA-TM-78463; A-7305) Avail: NTIS HC A02/MF A01 CSCL 11G

The toxicity of the pyrolysis gases from nine wood samples was investigated. The samples of hardwoods were aspen poplar, beech, yellow birch, and red oak. The samples of softwoods were western red cedar, Douglas fir, western hemlock, eastern white pine, and southern yellow pine. There was no significant difference between the wood samples under rising temperature conditions, which are intended to simulate a developing fire, or under fixed temperature conditions, which are intended to simulate a fully developed fire. This test method is used to determine whether a material is significantly more toxic than wood under the preflashover conditions of a developing fire. Author

N78-16096*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

TOXICITY OF PYROLYSIS GASES FROM ELASTOMERS

Carlos J. Hilado (San Francisco Univ.), Kay Li Kosola (San Francisco Univ.), Alida N. Solis (San Francisco Univ.), Demetrius A. Kourtides, and John A. Parker Dec. 1977 22 p refs
(NASA-TM-78461; A-7303) Avail: NTIS HC A02/MF A01 CSCL 07C

The toxicity of the pyrolysis gases from six elastomers was investigated. The elastomers were polyisoprene (natural rubber), styrene-butadiene rubber (SBR), ethylene propylene diene terpolymer (EPDM), acrylonitrile rubber, chlorosulfonated polyethylene rubber, and polychloroprene. The rising temperature and fixed temperature programs produced exactly the same rank order of materials based on time to death. Acryltonitrile rubber exhibited the greatest toxicity under these test conditions; carbon monoxide was not found in sufficient concentrations to be the primary cause of death. Author

24 COMPOSITE MATERIALS

Includes laminates.

N78-16097 Texas Univ., Austin.

A MICROSTRUCTURE CONTINUUM THEORY FOR LAMINATED ELASTIC COMPOSITES Ph.D. Thesis

Mohan Soni, Lal 1977 146 p
Avail: Univ. Microfilms Order No. 77-23034

A homogeneous continuum theory with microstructure was developed for composites with a large number of alternating layers of high stiffness reinforcement embedded in a matrix of elastomeric material. Based on the kinematics and constitutive relations for each layer, through explicit averaging and smoothing operations, an energy functional for the homogeneous model was developed. Interaction between the layers was permitted through the continuity of displacements across the interfaces of adjacent layers. A variational principle was used to obtain the governing equations of motion and boundary conditions of the microstructure theory. The relationship between the boundary conditions of microstructure theory and those of classical elasticity theory were established. A numerical procedure for solving the boundary value problems of the microstructure theory specialized for flat laminate geometries was developed using a displacement finite element. Dissert. Abstr.

N78-16098*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

MECHANICAL BEHAVIOR AND FRACTURE CHARACTERISTICS OF OFF-AXIS FIBER COMPOSITES. 2: THEORY AND COMPARISONS

Christos C. Chamis and John H. Sinclair Jan. 1978 29 p refs
(NASA-TP-1082; E-9269) Avail: NTIS HC A03/MF A01 CSCL 11D

The mechanical behavior and stresses inducing fracture modes of unidirectional high-modulus graphite-fiber/epoxy composites subjected to off-axis tensile loads were investigated theoretically. The investigation included the use of composite mechanics, combined-stress failure criteria, and finite-element stress analysis. The results are compared with experimental data and led to the formulation of criteria and convenient plotting procedures for identifying, characterizing, and quantifying these fracture modes. Author

N78-16099*# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.

EXPERIMENTAL STUDIES OF GRAPHITE-EPOXY AND BORON-EPOXY ANGLE PLY LAMINATES IN SHEAR

T. Weller Sep. 1977 89 p refs
(Grant NsG-7083)
(NASA-CR-145231) Avail: NTIS HC A05/MF A01 CSCL 11D

The nonlinear/inelastic response under inplane shear of a large variety of graphite-epoxy and boron-epoxy angle-ply laminates was tested. Their strength allowables were obtained and the mechanisms which govern their mode of failure were determined. Two types of specimens for the program were chosen, tested, and evaluated: shear panels stabilized by an aluminum honeycomb core and shear tubes. A modified biaxially compression/tension loaded picture frame was designed and utilized in the test program with the shear panels. The results obtained with this test technique categorically prefer the shear panels, rather than the tubes, for adequate and satisfactory experimental definition of the objectives. Test results indicate the existence of a so-called core-effect which ought to be considered when reducing experimental data for weak in shear laminates. Author

N78-16100*# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.

ANALYTICAL AND EXPERIMENTAL STUDIES OF GRAPHITE-EPOXY AND BORON-EPOXY ANGLE PLY LAMINATES IN SHEAR

T. Weller Sep. 1977 46 p refs
(Grant NsG-7083)
(NASA-CR-145232) Avail: NTIS HC A03/MF A01 CSCL 11D

The results of a comparison study between a test program on the inelastic response under inplane shear over a wide range of graphite-epoxy and boron-epoxy angle-ply laminates are reported. This investigation was aimed at evaluating the applicability and adequacy of these analyses to predict satisfactorily the responses of angle-ply laminates. It was observed that these analytical tools are inadequate for this purpose as they fail to predict with sufficient confidence the shape of response and in particular the strength values associated with a given laminate configuration. Consequently, they do not provide the sought-after information about failure mechanisms which trigger failure of a particular designed laminate. Author

N78-16101*# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.

EXPERIMENTAL STUDIES OF GRAPHITE-EPOXY AND BORON-EPOXY ANGLE PLY LAMINATES IN COMPRESSION

T. Weller Sep. 1977 108 p refs
(Grant NsG-7083)
(NASA-CR-145233) Avail: NTIS HC A06/MF A01 CSCL 11D

A test program aimed at studying the nonlinear/inelastic response under axial compression across a wide range of angle ply was graphite-epoxy and boron-epoxy laminates was presented and described. The strength allowables corresponding to the various laminate configurations were defined and the failure mechanisms which dictate their mode of failure were detected. The program involved two types of specimens for each laminate configuration: compression sandwich coupons and compression tubes. The test results indicate that the coupons perform better than the tubes displaying considerably high stress-strain allowables and mechanical properties relative to the tubes. Also, it is observed that depending on their dimensions the coupons are susceptible to very pronounced edge effects. This sensitivity results in assigning to the laminate conservative mechanical properties rather than the actual ones. Author

N78-16102*# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.

ANALYTICAL AND EXPERIMENTAL STUDIES OF GRAPHITE-EPOXY AND BORON-EPOXY ANGLE PLY LAMINATES IN COMPRESSION
T. Weller Sep. 1977 66 p refs
(Grant NsG-7083)
(NASA-CR-145234) Avail: NTIS HC A04/MF A01 CSCL 11D

The applicability and adequacy of several computer techniques in predicting satisfactorily the nonlinear/inelastic response of angle ply laminates were evaluated. The analytical predictions were correlated with the results of a test program on the inelastic response under axial compression of a large variety of graphite-epoxy and boron-epoxy angle ply laminates. These comparison studies indicate that neither of the abovementioned analyses can satisfactorily predict either the mode of response or the ultimate stress value corresponding to a particular angle ply laminate configuration. Consequently, also the simple failure mechanisms assumed in the analytical models were not verified. Author

N78-16103*# Cornell Univ., Ithaca, N. Y. Dept. of Theorectical and Applied Mechanics.
IMPACT ON MULTILAYERED COMPOSITE PLATES Final Report, Sep. 1975 - Dec. 1976
B. S. Kim and F. C. Moon Apr. 1977 121 p refs
(Grant NsG-3080)
(NASA-CR-135247) Avail: NTIS HC A06/MF A01 CSCL 11D

Stress wave propagation in a multilayer composite plate due to impact was examined by means of the anisotropic elasticity theory. The plate was modelled as a number of identical anisotropic layers and the approximate plate theory of Mindlin was then applied to each layer to obtain a set of difference-differential equations of motion. Dispersion relations for harmonic waves and correction factors were found. The governing equations were reduced to difference equations via integral transforms. With given impact boundary conditions these equations were solved for an arbitrary number of layers in the plate and the transient propagation of waves was calculated by means of a Fast Fourier Transform algorithm. The multilayered plate problem was extended to examine the effect of damping layers present between two elastic layers. A reduction of the interlaminar normal stress was significant when the thickness of damping layer was increased but the effect was mostly due to the softness of the damping layer. Finally, the problem of a composite plate with a crack on the interlaminar boundary was formulated. Author

N78-16104# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
IMPACT DAMAGE IN CARBON-CARBON COMPOSITES Technical Report, 1 May - 31 Oct. 1977
William F. Adler (Effects Technology, Inc.) and Anthony G. Evans 11 Nov. 1977 84 p refs
(Contract N00014-76-C-0854; NR Proj. 032-570)
(AD-A047306; SC5076.4TR) Avail: NTIS HC A05/MF A01 CSCL 11/4

The damage to three-dimensional orthogonal carbon-carbon composites created by particle impacts ranging from 1800 to 6000/ms has been characterized for three weave constructions at both ambient and at temperatures up to 3500 C. The subsurface damage modes in the vicinity of the impact crater are described for the range of conditions investigated. Hypotheses are advanced concerning the failure modes and kinetics for the material ejected from the crater based on examination of sectioned specimens and high-speed photographic sequences. Penetration, compliance and plane-strain compression tests are utilized to supply mechanical characterization data for the dominant modes of failure, which are analyzed in terms of the dynamic stress states which develop in the three-dimensional composites during the collision cycle. Author (GRA)

N78-16105# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
REPLACEMENT CARBON FIBERS FOR THERMAL PROTECTION APPLICATIONS Final Report, 1 Jan. - 26 Apr. 1977
Donald L. Schmidt Aug. 1977 55 p refs Presented at 22nd Natl. SAMPE Symp. and Exhibition, San Diego, Calif., 26-28 Apr. 1977
(AD-A047293; AFML-TR-77-68) Avail: NTIS HC A04/MF A01 CSCL 11/5

Fibrous carbons are low cost engineering materials. They are used in a large number of specialty aerospace and industrial applications because of their flexibility, high thermal stability, light weight, chemical inertness, low thermal conductivity, dimensional stability, low electrical resistivity, nontoxicity, nonflammability, and other attributes. Most grades of fibrous carbon are manufactured from the precursor continuous filament rayon. Because of declining commercial markets for this textile product in the United States, continued availability is becoming more questionable. The evaluation of substitute materials, and, the development of equivalent replacement materials have been initiated to preclude future shortages or production delays. The area of greatest concern is the development of organic fabrics, which can later be converted to carbon fabrics for reinforcement of thermal protection composites. Fibrous organic precursors receiving the most attention are staple rayon, pitch and polyacrylonitrile (PAN) materials. This report describes the status of candidate precursor fibers and the carbonized products derived from these materials. Author (GRA)

N78-16106# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavement Lab.
PRELIMINARY INVESTIGATION OF GENERAL-PURPOSE MAT/PANEL MATERIALS Final Report, May - Sep. 1976
Hugh L. Green, Dewey W. White, Jr., and Gordon L. Carr May 1977 143 p
(DA Proj. 1T1-62112-A-528; DA Proj. 1F7-63727-DG-01)
(AD-A047241; WES-MP-S-77-9) Avail: NTIS HC A07/MF A01 CSCL 13/3

The objective of this study was to determine the feasibility of a general-purpose mat/panel for the theater of operations for multiusages other than as aircraft landing mats and to establish criteria for future design of such mat/panels. Several test sections were used to test 11 different fabricated designs of materials and several additional materials were tested as potential items. Accelerated traffic was applied using an M54, 5-ton military truck loaded with 20,000 lb for a gross load of 40,000 lb and with tires inflated to 70 psi. Comparative laboratory tests of the structural properties of the panels were also conducted. Four of the panels sustained the maximum crush test of 1250 psi. From these tests, the following criteria were established as a guideline in further testing and developing a general-purpose mat/panel: The panels must be capable of sustaining 3000 passes of the M54 truck with gross weight of 40,000 lb using tires inflated to 70 psi on a loose dry sandy soil. Individual mats must be of such size, shape, and weight as to be handled by two men. Panels must be provided with connectors on all edges. Panels must be coated with an antiskid to provide a coefficient of friction between 0.4 and 0.8 when wet or dry. Panels must withstand a crushing load of 1250 psi, as determined when using a container corner. Mats must support 400 lb per ft of width at a maximum deflection of 4 in. when tested as a beam using a 10-ft span and 1/3-point loading. Mats must support 4000 lb per ft of width at a maximum midpoint deflection of 4 in. when tested as a 12-ft column. Multimillion square feet production cost should be approximately $3.00 per sq ft. GRA

N78-16107# Los Alamos Scientific Lab., N. Mex.
CHEMICAL VAPOR DEPOSITION OF TANTALUM ON GRAPHITE CLOTH FOR MAKING HOT PRESSED FIBER REINFORCED CARBIDE-GRAPHITE COMPOSITE
C. M. Hollabaugh, K. V. Davidson, C. L. Radosevich, R. E. Riley, and T. C. Wallace 1977 18 p refs Presented at 6th Intern. Conf. on Chem. Vapor Deposition, Atlanta, 10-13 Oct. 1977
(Contract W-7405-eng-36)
(LA-UR-77-1261; Conf-771004-1) Avail: NTIS HC A02/MF A01

Conditions for the chemical vapor deposition of a uniform coating of Ta on fibers of a woven graphite cloth were established. The effect of gas composition, pressure, and temperature were investigated, and the conditions that gave the desired results are presented. Several layers of the coated cloth were hot pressed to produce a TaC-C composite having uniformly dispersed, fine-grained TaC in graphite. Three compositions were hot pressed: 15, 25, and 40 volume percent carbide. ERA

N78-16108# Utah Univ., Salt Lake City. Dept. of Materials Science and Engineering.
FOAM GLASS INSULATION FROM WASTE GLASS Final Report
Wendell G. Oakseson Aug. 1977 140 p refs
(Grant EPA-R-800937-02)
(PB-272761/8; EPA-600/3-77-030) Avail: NTIS HC A07/MF A01 CSCL 13B

Problems inherent with the use of water, carbon black, and calcium carbonate as the foaming agents, were identified and many were solved by various techniques. Water was found to be best suited for micrometer sized particles to 0.6 cm pellets, while carbon and CaCO3 yielded better products for larger objects. Large amounts of water can be rapidly incorporated into glass by using a sodium hydroxide solution in a heated autoclave. The foaming process with carbon black was examined by analysis of the density, pore size, and open porosity of the foamed piece. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N78-16109 Texas Univ., Austin.
ELECTRON DIFFRACTION STUDIES OF GASES AT ELEVATED TEMPERATURES: CARBON TETRACHLORIDE, TRICHLOROMETHYL, AND CHLOROBENZENE Ph.D. Thesis
James Selden Bogard 1977 87 p
Avail: Univ. Microfilms Order No. 77-22920

Thrichloromethyl and diatomic chlorine were generated as thermal decomposition products of carbon tetrachloride in quantities sufficient to determine the structure of the radical. A conventional photographic plate electron diffraction apparatus was used for the study; the oven used consisted of a 20 gauge hypodermic needle through which an electric current was passed to provide ohmic heating. Reaction progress and the appearance of reaction byproducts during the course of an experiment were monitored by mass spectrometry. Mean amplitudes of vibration were calculated for a range of temperatures for both carbon tetrachloride and chlorobenzene using harmonic molecular force fields and a Boltzmann distribution of vibrational energy levels. Literature values for force constants were used in the calculations. Dissert. Abstr.

N78-16110 Hawaii Univ., Honolulu.
ANGULAR-DEPENDENT X-RAY PHOTOELECTRON SPECTROSCOPY OF SOLIDS Ph.D. Thesis
Ronald J. Baird 1977 248 p
Avail: Univ. Microfilms Order No. 77-23483

Modifications made to a photoelectron spectrometer for determining the angular dependence of X ray photoelectron spectra of single crystals and polycrystalline samples are described. In a series of experiments on aluminum diffraction gratings with oxide overlayers, the effect of periodic surface roughness on the enhancement of surface sensitivity was measured. Also, the angular dependence of the relative intensities of the bulk and surface plasmon loss peaks associated with the A12p core level was measured for clean, smooth, polycrystalline aluminum samples. In measurements of the angular dependence of the photoelectron spectra from a gold single crystal, two effects were studied. The angular dependence of the integrated intensity of the gold core and valence levels show pronounced fine structure. The shapes of the Au5d valence-band spectra show changes which are related to the direction of emission. Dissert. Abstr.

N78-16111 Wayne State Univ., Detroit, Mich.
INVESTIGATIONS OF THE FRANCK-CONDON BARRIERS TO INNER AND OUTER-SPHERE ELECTRON TRANSFER REACTIONS Ph.D. Thesis
Bill Durham 1977 192 p
Avail: Univ. Microfilms Order No. 77-23968

A large number of electron transfer reactions involving cobalt complexes containing tetraaza(N4) macrocyclic ligands were investigated. The self-exchange rate constants for several couples of the general formula Co(N4)(OH2)2(3+,2+) were determined. These rate constants span a range from 0.000001 to 0.000003/m/sec. The self-exchange rate constants were used to show that the cross reaction rate constants, obtained for the reactions of two of these complexes with a variety of different oxidants and reductants, are in agreement with those calculated using the free energy relations developed by Marcus to at least an order of magnitude. Some substantial deviations which involve Co(OH2)6(3+) were noted. Calculations of the contributions to the total free-energy of activation for the outer-sphere self-exchange reactions have been made using the equations developed by Marcus and others. Dissert. Abstr.

N78-16112 Rutgers - The State Univ., New Brunswick, N. J.
FAR INFRARED LASER SPECTROSCOPY OF ErFeO3 Ph.D. Thesis
Dennis Kirkwood Mansfield 1977 129 p
Avail: Univ. Microfilms Order No. 77-24998

Using a far infrared laser as a radiation source resonant CEF absorptions were observed at various sample temperatures and in various crystalline directions of laser propagation. From the absorption data the transition selection rules, g values, zero field level separation and mixing of states interactions of the two lowest lying Er(+3) Kramer's doublets were characterized. The characterization was done using the four level hamiltonian of Malozemoff and by treating the ER(+3) ions as if they were unaffected by the presence of the Fe(+3) molecular fields. In addition, the observation of non-CEF absorptions was reported and unsuccessful attempts to explain these absorptions as iron antiferromagnetic resonances were described. Dissert. Abstr.

N78-16113 Texas Univ., Austin.
FIXED-BED ION EXCHANGE WITH DIFFERING IONIC MOBILITIES AND NONLINEAR EQUILIBRIA Ph.D. Thesis
Kenneth Lynn Erickson 1977 467 p
Avail: Univ. Microfilms Order No. 77-22949

A mathematical model was developed for predicting the behavior of fixed-bed ion exchange columns for the situation involving a microreticular ion exchange resin and two exchanging counter ions which had significantly different ionic mobilities, which exhibited nonlinear equilibrium relationships, and for which the rate of ion exchange was controlled primarily by diffusion within the resin particles. The model was evaluated by comparing predicted column behavior with the corresponding experimentally determined behavior. The agreement between predicted and experimental results was reasonably good and indicated that it might be possible to further develop the model so that it could be applied to the design of a variety of industrial ion exchange processes. Dissert. Abstr.

N78-16114 Pennsylvania State Univ., University Park.
A GENERALIZED HARD SPHERE EQUATION OF STATE FOR VAPOR-LIQUID EQUILIBRIA PREDICTION Ph.D. Thesis
Michael S. Graboski 1977 237 p
Avail: Univ. Microfilms Order No. 77-23234

A new generalized equation of state for spherical molecules based upon the properties of hard spheres and the perturbation theory of liquids is presented. The equation of state requires only the critical pressure and critical temperature of the fluid as input parameters. Vapor liquid equilibria are calculated in terms of two mixing models along with each of two extended equations of state. In both cases, the one fluid approach yields better results than the hard sphere expansion model. Either equation of state gives a very good representation of the phase equilibria behavior of a variety of hydrocarbon systems. The form based on the convex particle properties appears to account for nonspherical interactions better than the model based on the equivalent spherical fluid. Dissert. Abstr.

N78-16115 Pennsylvania State Univ., University Park.
STUDIES OF COMBUSTION OF LIQUID PARTICULATE SMOKE IN A WELL-STIRRED COMBUSTOR Ph.D. Thesis

Bimal K. Biswas 1977 182 p
Avail: Univ. Microfilms Order No. 77-23211

Combustion studies of a liquid particulate type of smoke in a well stirred combustor are presented. A method of continuous generation of smoke was developed by pyrolizing computer card clippings in a fixed bed gas generator by a continuous and controlled feed mechanism. The smoke generated in this type apparatus was then burnt in a well stirred combustor. The well stirred section in the combustor was created by aerodynamic pattern of counter vortex flow of the combustion air. The above injection system to generate the pattern was developed primarily from water model studies. The experimental tests on a hot model showed that the counter vortex flow system gives excellent flame stability characteristics due to recirculation, uniformity of temperature and concentration were found to be such that the zone could be approximated as a well stirred combustor.

Dissert. Abstr.

N78-16116 Arizona Univ., Tucson.
SAMPLE INTRODUCTION TECHNIQUES FOR ANALYTICAL ATOMIC SPECTROSCOPY Ph.D. Thesis
Robert Carl Fry 1977 104 p
Avail: Univ. Microfilms Order No. 77-29347

A 6mm o.d. metal nebulizer with non-recessed orifice and peristalic pump sample feed that reduces the required minimum sample to approximately 1 ml was developed for use in the flame spectrochemical analysis of complex materials, and the micronanalysis of miniature samples. The problem of molecular spectral interferences by undissociated inorganic matrix salts in the direct analysis of digested or untreated complex materials is addressed as well as concentration sensitivity in the atomic spectral determination of toxic species. Dissert. Abstr.

N78-16117 Houston Univ., Tex.
MICRO ANALYSIS OF VOLATILE METABOLITES IN BIOLOGICAL FLUIDS BY GAS CHROMATOGRAPHY Ph.D. Thesis
Fikry Fouad Andrawes 1977 84 p
Avail: Univ. Microfilms Order No. 77-28764

An ether extraction method and a gas phase stripping technique are described for concentrating and analyzing organic volatiles in samples as small as 100 microliters of biological fluids or 100 milligrams of tissue. A comparison of serum profiles obtained using the ether extraction method indicates that serum profiles show less variation among individuals than do urine profiles obtained from 50 healthy subjects. The gas phase stripping technique permits analysis of small samples of fluid (about 2 to 3 milliliters) at low temperature, and permits a large area of contact between the fluid and the pure helium carrier gas. Dissert. Abstr.

N78-16118*# Aeronautical Research Associates of Princeton, Inc., N. J.
A SECOND-ORDER CLOSURE ANALYSIS OF TURBULENT DIFFUSION FLAMES
A. K. Varma, E. Stokes Fishburne, and Robert A. Beddini Jun. 1977 85 p refs
(Contract NAS1-12412)
(NASA-CR-145226) Avail: NTIS HC A05/MF A01 CSCL 21B

A complete second-order closure computer program for the investigation of compressible, turbulent, reacting shear layers was developed. The equations for the means and the second order correlations were derived from the time-averaged Navier-Stokes equations and contain third order and higher order correlations, which have to be modeled in terms of the lower-order correlations to close the system of equations. In addition to fluid mechanical turbulence models and parameters used in previous studies of a variety of incompressible and compressible shear flows, a number of additional scalar correlations were modeled for chemically reacting flows, and a typical eddy model developed for the joint probability density function for all the scalars. The program which is capable of handling multi-species, multistep chemical reactions, was used to calculate nonreacting and reacting flows in a hydrogen-air diffusion flame. Author

N78-16119*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
THERMODYNAMIC AND RELATED PROPERTIES OF OXYGEN FROM THE TRIPLE POINT TO 300 K AT PRESSURES TO 1000 BAR
L. A. Weber Dec. 1977 164 p refs
(NASA-RP-1011; NBSIR-77-865) Avail: NTIS HC A08/MF A01 CSCL 07D

The results of an experimental program are presented in the form of PVT data in the temperature range 58 to 300 K at pressures up to 800 bar. Tables of the derived thermodynamic properties on isobars to 1000 bar are given, including density, internal energy, enthalpy, entropy, specific heats at constant volume and constant pressure, velocity of sound, and the surface derivatives (delta P/delta T) sub rho and (delta P/delta Rho) sub T. Auxiliary tables in engineering units are also given. The accuracy of the data is discussed and comparisons are made with previous data. Author

N78-16120# Illinois Univ., Urbana-Champaign. Dept. of Chemistry.
EXOTHERMIC CYCLIC PEROXIDE REACTIONS. DECOMPOSITION OF A 1,2,4-TRIOXANE
Gary B. Schuster and Lynn A. Bryant 23 May 1977 1 p refs
(Contract N00014-76-C-0745)
(AD-A046640) Avail: NTIS HC A02/MF A01 CSCL 07/3

Results of the thermolysis of the peroxide, trans-4,4-dimethyl-2,3,5-trioxabicyclo(4.4.0)decane, are discussed. It was prepared by the procedure of Payne from cyclohexene, acetone and hydrogen peroxide. Degassed solutions in octane or diphenyl ether were thermolyzed at temperatures ranging from 189 C to 160 C. Analysis of the resulting product mixture by mass and nmr spectroscopy and gas chromatography revealed acetone and adipaldehyde. The yield of acetone was essentially quantitative, however, the amount of aldehyde formed was dependent upon the extent of reaction. Investigation of the kinetics for the decomposition of the peroxide indicated that the rate of reaction was cleanly first order in peroxide concentration. The peroxide is potentially a chemiluminescent intermediate. In summary, the relatively stable cyclic peroxide undergoes unimolecular cleavage to form carbonyl compounds acetone and adipaldehyde with high efficiency. No chemiluminescence was observed during this reaction although sufficient energy is available to form the lowest triplet state of the observed products. GRA

N78-16121# National Bureau of Standards, Washington, D. C.
A COMPUTER-ASSISTED EVALUATION OF THE THERMOCHEMICAL DATA OF THE COMPOUNDS OF THORIUM
D. D. Wagman, R. H. Schumm, and V. B. Parker Aug. 1977 94 p refs
(PB-273171/9; NBSIR-77-1300) Avail: NTIS HC A05/MF A01 CSCL 07D

Selected values are given for the thermochemical properties of the compounds of thorium. THey are obtained from a computer-assisted least sums-least squares approach to the evaluation of thermodynamic data networks. The properties given, where data are available, are enthalpy of formation, Gibbs energy of formation, and entropy at 298.15 K delta Hf (298), delta Gf (298), and S(298). The values are consistent with the CODATA Key Values for Thermodynamics. The reaction catalog from which this self consistent set of values is generated is given with a statistical analysis. Some thermal functions are also given, as well as detailed comments when necessary. GRA

N78-16122# Princeton Univ., N. J. Dept. of Chemistry
UNUSUAL OXIDATION STATES AND COORDINATION NUMBERS OF THE LIGHT ELEMENTS Final Report, 1 Mar. 1968 - 31 Dec. 1973
Leland C. Allen Oct. 1977 4 p refs
(Contract N00014-67-A-0151-0016)
(AD-A046916) Avail: NTIS HC A02/MF A01 CSCL 07/2

Stable states and molecular complexes of HeF+, HeO+, HeN+, NeF+, NeO+, NeN+, ArF+, and ArO+ were studied by electronic structure theory calculations. The possible existence of noble gas boron complexes was also investigated.

Author (GRA)

N78-16123# Texas A&M Univ., College Station. Dept. of Chemistry.
AN ELECTROCHEMICAL INVESTIGATION OF SOME RHENIUM CARBONYL PORPHYRINS
Darrell D. Axtell, G. R. Miller, Tom H. Ridgway, and Minoru Tsutsui 18 Nov. 1977 12 p refs
(Contract N00014-75-C-0417)
(AD-A047271; TR-18) Avail: NTIS HC A02/MF A01 CSCL 07/3

Earlier reports described the synthesis and X-ray crystallographic characterization of mono- and di-rhenium carbonyl porphyrins. The X-ray data indicated that in some cases an inter-molecular rhenium-rhenium bond was formed as a result of chemical oxidation. GRA

N78-16124# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
CARBON: A NEW VIEW OF ITS HIGH-TEMPERATURE BEHAVIOR Interim Report
A. Greenville Whittaker 20 Oct. 1977 12 p refs
(Contract F04701-77-C-0078)
(AD-A047162; TR-0078(3950-03)-1) Avail: NTIS HC A02/MF A01 CSCL 07/4

An increasing body of research indicates that carbon can exist in a number of polymorphic 'linear' forms. It is proposed that these forms occur because of a shift to triple bounding in the carbon system as temperature increases above 2600 K. It is also proposed that graphite can dissociate into triple-bonded molecules by a simple mechanism. Author (GRA)

N78-16125# Rutgers - The State Univ., New Brunswick, N. J. College of Engineering.
A HIGH PRESSURE X-RAY STUDY OF POLYVINYLIDENE FLUORIDE, PHASE 2
B. A. Newman, C. H. Yoon, and K. D. Pae 1 Nov. 1977 20 p refs
(Contract N00014-75-C-0540)
(AD-A047085; TR-11) Avail: NTIS HC A02/MF A01 CSCL 07/4

An X-ray diffraction study of poly(vinylidene fluoride) Phase II has been been carried out at pressures up to 14,000 kg/sq cm at room temperature. The crystal modification Phase II was found to be stable in this pressure range. The crystal lattice compressibility was studied at different pressures, and it was found that the variation of lattice strain with pressure was best represented by the Tait function. It was found that the linear compressibility in the chain direction is much greater than is the case for linear polyethylene. GRA

N78-16126# Union Carbide Corp., Tarrytown, N.Y. Corporate Research Lab.
D2-M-CARBORANE-SILOXANES. 6: OXIDATIVE STABILIZATION OF VULCANIZATES WITH FERRIC OXIDE
E. N. Peters, D. D. Stewart, J. J. Bohan, and D. W. Mo[illegible]il 17 Oct. 1977 21 p refs Prepared in cooperation with [illegible] Carbide Corp., Bound Brook, N. J.
(Contract N00014-72-C-0277)
(AD-A046918; CRL-T-860) Avail: NTIS HC A02/MF A01 CSCL 07/4

Ferric oxide produced from iron pentacarbonyl was evaluat[illegible] as an oxidative stabilizer in D2-m-carborane-siloxane and polydimethylsiloxane vulcanizates. The results indicate a significant improvement in efficiency compared to powdered ferric oxide. Thus a carborane-siloxane vulcanizate retained elastomeric properties after 1000 hours in air at 315 C. The practical upper use temperature for carborane-siloxane vulcanizates was evaluated by heat aging samples at 340 and 370 C. Author (GRA)

N78-16127# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
PROCEEDINGS OF THE ARPA/AFML REVIEW OF PROGRESS IN QUANTITATIVE NONDESTRUCTIVE EVALUATION, NDE Annual Report, 18 Jul. 1975 - 3 Sep. 1976
Donald O. Thompson Sep. 1977 278 p Proc. held at Pacific Grove State Beach, Calif., 31 Aug. - 3 Sep. 1976
(Contract F33615-74-C-5180; AF Proj. 7351)
(AD-A046917; SC595.16AR; AFML-TR-77-44; AR-2) Avail: NTIS HC A13/MF A01 CSCL 14/2

The edited transcripts of the ARPA/AFML Review of Quantitative NDE held on August 31 - September 3, 1976, at Asilomar Conference Facility, Pacific Grove State Beach, Calif., are presented in this document. Several key topics form the core of these presentations and discussions. They include quantitative ultrasonics, adhesives and composites, emissions related to failure prediction, residual stress. In addition a Mini-Symposium is presented related to Advances in Electromagnetic Transducers. It is believed that this document provides a reasonable summary of NDE research and development currently underway. Author (GRA)

N78-16128# Los Alamos Scientific Lab., N. Mex.
COULOMETER OPERATOR'S MANUAL
A. L. Criscuolo Jul. 1977 20 p refs
(Contract W-7405-eng-36)
(LA-6883-MS) Avail: NTIS HC A02/MF A01

The coulometer control system which automates the titration of uranium and plutonium as performed is described by the CMB-1 group. The system consists of a printer, microcontroller, and coulometer, all of which are controlled by an algorithm stored in the microcontroller read-only memory. The titration procedure using the coulometer control system, in theory, and maintenance are discussed. ERA

N78-16129# National Aviation Facilities Experimental Center, Atlantic City, N. J.
REEVALUATION OF BURNER CHARACTERISTICS FOR FIRE RESISTANCE TESTS Final Report, Sep. 1975 - Jun. 1976
J. E. Demaree Jan. 1977 41 p
(AD-A035595; FAA-NA-76-43; FAA-RD-76-213) Avail: NTIS HC A03/MF A01 CSCL 13/1

Laboratory evaluations were performed to determine the flame characteristics of the Lennox OB-32 conversion oil burner. Three commercially available burners were modified to produce a flame with Characteristics similar to the Lenox OB-32. Various apparatus used in this determination are described in this report. It was concluded that the three burners tested could be modified to produce flame patterns and characteristics comparable to the Lennox OB-32 conversion oil burner. The burner described in this report has been used to determine the fire resistance of flexible hose assemblies under simulated conditions. The test was aimed at producing a typical aircraft power plant fire. Author (GRA)

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N78-16130 Brigham Young Univ., Provo, Utah.
DEHANCEMENT OF GOLD DIFFUSION IN LEAD BY SMALL CONCENTRATIONS OF IMPURITIES IN THE LEAD Ph.D. Thesis
John Gerald Melville, II 1977 165 p
Avail: Univ. Microfilms Order No. 77-23175

The diffusion of gold in dilute (Pb(Pd) and Pb(Ag) alloys was measured in the range 180-300 C using a radioactive tracer and sectioning technique. A large dehancement effect was observed in both systems, the diffusivity being reduced up to 20% for impurity concentrations near the solubility limit. The diffusion of gold in pure le[illegible] was measured in the range 60-290 C. The solid solubility o[illegible] adium in lead was determined by residual resistivity measurements. A thermodynamic model including substitutionals, interstitials, interstitial vacancy pairs, and diplons is developed and found to satisfactorily describe the data. This model reveals a consistency between dehancement results and impurity diffusivity measurements. Dissert. Abstr.

N78-16131 Case Western Reserve Univ., Cleveland, Ohio.
ELECTRICAL RESISTIVITY AND SPECIFIC HEAT OF NICKEL NEAR THE CURIE TEMPERATURE Ph.D. Thesis
Edward Joseph Haugland 1977 106 p
Avail: Univ. Microfilms Order No. 77-25163

The temperature coefficient of resistivity, drho/dT, and the

specific heat, C sub p, of 0.002 in. diameter nickel wires were investigated in the vicinity of the Curie Temperature, T sub c. Using a modification of the ace temperature modulation technique, drho/dT and C sub p were measured simultaneously in slow continuous temperature sweeps through the Curie point with the majority of data being taken within 5 C of T sub c. The results show that, to a resolution of 0.1 C, drho/dT and C sub p have the same temperature dependence on either side of T sub c. This is in accord with the theory of Fisher and Langer as modified by Kasuya and Kondo and Geldart and Richard. With a reasonable extrapolation of these results, the magnetic energy involved in the phase transition is estimated to be 0.013 eV/atom. Dissert. Abstr.

N78-16132 Case Western Reserve Univ., Cleveland, Ohio.
SURFACE ASPECTS OF PITTING AND STRESS CORROSION CRACKING Ph.D. Thesis
John Jay Truhan, Jr. 1977 988 p
Avail: Univ. Microfilms Order No. 77-25200

The pitting and stress corrosion cracking of a stable austenitic stainless steel in aqueous chloride environments were investigated using a secondary ion mass spectrometer as the primary experimental technique. The surface concentration of hydrogen, oxygen, the hydroxide, and chloride ion, magnesium or sodium, chromium and nickel were measured as a function of potential in both aqueous sodium chloride and magnesium chloride environments at room temperature and boiling temperatures. It was found that, under anodic conditions, a sharp increase in the chloride concentration was observed to occur for all environmental conditions. The increase may be associated with the formation of an iron chloride complex. Higher localized chloride concentrations at pits and cracks were also detected with an electron microprobe. Dissert. Abstr.

N78-16133 Rensselaer Polytechnic Inst., Troy, N. Y.
THE CORROSION FATIGUE BEHAVIOR OF A HIGH PURITY Al-Zn-Mg-Cu ALLOY Ph.D. Thesis
Edward Freer Smith, III 1977 206 p
Avail: Univ. Microfilms Order No. 77-23805

The effect of hydrogen on the corrosion fatigue behavior of an Al-5Zn-2.5Mg-1.5Cu alloy was investigated. A constant mean load, S-N type test method was used to monitor the fatigue response under air and .5N NaCl environments. In both cases, specific experiments were conducted in an attempt to determine the operating failure mechanism. Results indicated that the observed fatigue behavior could be explained by a hydrogen embrittlement mechanism. A model was developed which demonstrated quantitative agreement between the observed fracture morphology and the calculated dislocation transport efficiency. For low efficiency conditions, the observed fracture mode was thought to be hydrogen induced grain boundary separation. As the efficiency increased, the grain boundaries were depleted of hydrogen and the crack propagated along the embrittlement transgranular path. Dissert. Abstr.

N78-16134 Case Western Reserve Univ., Cleveland, Ohio.
CONTROL OF SOLIDIFICATION STRUCTURE AND ITS EFFECT ON THE MECHANICAL PROPERTIES OF GRAY IRON Ph.D. Thesis
Gary Frank Ruff 1977 250 p
Avail: Univ. Microfilms Order No. 77-25189

The influence of changes in the structure of austenitic dendrites, graphite flakes and eutectic cells on the mechanical properties of gray irons was investigated by making different additions to various carbon equivalent base melts. The inoculants and elements added were selected on the basis of their effect in controlling both the nucleation and growth of graphite and primary austenite. Round bars of various diameters were cast in sand molds and their microstructure, tensile, transverse and hardness properties were evaluated. In addition, by accounting for surface effects, yielding and differences in tensile and compressive properties, a relation for predicting the transverse strength from the tensile strength and plastic strain was developed. Dissert. Abstr.

N78-16135 California Univ., Los Angeles.
MONOTONIC AND CYCLIC FRACTURE PROPERTIES AND THE CYCLICALLY AFFECTED FRACTURE TOUGHNESS OF 1Cr-Mo-V BAINITIC TURBINE STEELS Ph.D. Thesis
Itzhak Roman 1977 334 p
Avail: Univ. Microfilms Order No. 77-23919

The cyclically affected fracture toughness of metals in general, and 1Cr-Mo-V steam turbine rotor steel in particular was studied using a model which combines macroscopic fracture criteria with the assumption that transient flow properties of material in the cyclic plastic zone can be simulated by those of macroscopic low cycle fatigue specimens, tested in reversed strain control. Little or no changes in the cleavage fracture toughness due to cyclic loading is predicted or observed for materials that cycle strain harden (e.g., rail steel) or in the fracture toughness of other materials that cycle strain harden and fracture by rupture. An increase in the fracture toughness is predicted and observed for materials that cycle strain soften (e.g., 1Cr-Mo-V and 18 Ni 300 maraging steels), irrespective of fracture mode. Changes in the fracture toughness increase with both the number of cycles of applied load and the reversed plastic strain range. Dissert. Abstr.

N78-16136 Pittsburgh Univ., Pa.
SIMULATION OF HEAT FLOW AND THERMAL STRESSES IN CONTINUOUS CASTING: APPLICATION OF THE MODEL TO INTERNAL CRACKING Ph.D. Thesis
Jacob Mathew 1977 386 p
Avail: Univ. Microfilms Order No. 77-23558

The finite element method was used to model the heat flow and thermal stresses in the steady state continuous casting of cylindrical ingots. The simulation applied to the internal cracking in the continuous casting of ferrous and nonferrous alloys. The maximum normalized stress parameter is found to give a good qualitative correlation between the hot tearing tendency of the castings and the casting rate and the casting size. The effect of other operating parameters like mold size, pouring temperature, intensity of secondary cooling and a reduced cooling zone on the hot tearing tendency is examined. The simulation is also useful in predicting the grain size in the casting, formation of ingot butt and the variation of the mold heat flux in continuous casting. Dissert. Abstr.

N78-16137 Rensselaer Polytechnic Inst., Troy, N. Y.
THE HIGH TEMPERATURE DIFFUSION CHARACTERISTICS OF THE ALKALI METALS IN ZIRCALOY-2, 304 STAINLESS STEEL, AND TANTALUM Ph.D. Thesis
Mark Ellis Koslin 1977 140 p
Avail: Univ. Microfilms Order No. 77-23791

The diffusion rates of the alkali metals in zircaloy-2, 304 stainless steel, and tantalum, were determined using a mass spectrometer technique. The mass spectrometer also provided a means for determining an allotropic phase change for the stainless steel at 955 C, and a phase transition region between 772 C and 1072 C exists for the zircaloy-2. Diffusion rates were measured in thin (0.001' and 0.0005') ribbons which were used as high temperature thermal ion sources, and the alkali metals were naturally occurring impurities. In the temperature and pressure regime in which diffusion measurements were made, the solute atoms evaporated from the ribbon filaments as soon as the impurities diffused to the surface, and a fraction of these impurity atoms were ionized according to the Langmuir Saha relation. These ions were then accelerated, mass analyzed, and detected by the double focusing spectrometer. Dissert. Abstr.

N78-16138 Case Western Reserve Univ., Cleveland, Ohio.
MICROSTRUCTURE-MECHANICAL PROPERTY RELATIONSHIPS IN AN MgO-PARTIALLY-STABILIZED ZIRCONIA Ph.D. Thesis
Douglas Lloyd Porter 1977 190 p
Avail: Univ. Microfilms Order No. 77-25185

A commercial 8.1 mole % MgO-PSZ was solution annealed and then subjected to a wide range of aging treatments in the 1000-1500 C temperature range. An extensive variety of microstructures resulted based upon the competition of a sluggish eutectoid decomposition with the precipitation of nearly pure ZrO_2 in the cubic solid solution as well as the completeness of reaction. At 1000 C to approximately 1100 C only the eutectoid reaction was observed and mechanical properties were poor. At approximately 1150 C to 1300 C both reactions occurred but grain boundary precipitation of ZrO_2, produced as a eutectoid

product, severely weakened the material. At 1400 C to 1500 C the precipitation reaction alone occurred and a peak in microhardness, bend strength, and fracture toughness was observed with aging time. Dissert. Abstr.

N78-16139 Rensselaer Polytechnic Inst., Troy, N. Y.
A STUDY OF RADIATION-INDUCED SWELLING IN STAINLESS STEEL WELD METAL Ph.D. Thesis
Gerald Joseph Bruck 1977 187 p
Avail: Univ. Microfilms Order No. 77-23779

Changes in concentration of both major components and minor elements in an iron-chromium-nickel base alloy dramatically affect susceptibility to radiation-induced swelling. Substantial changes in composition occur in a weld as a result of segregation during solidification. Inhomogeneous swelling should then occur in irradiated weld metal in a manner related to the inhomogeneity in composition. Such swelling inhomogeneity was observed in a welded 65Fe-15Cr-20Ni base alloy modified with, the swelling inhibitors, silicon (0.35 w/o) plus titanium (0.1 w/o). Swelling at cell boundaries was approximately one-half the swelling at cell surfaces. Electron microprobe analysis revealed that the magnitude and variations in swelling were attributable to microsegregation of iron, chromium, nickel and silicon.
Dissert. Abstr.

N78-16140 Rensselaer Polytechnic Inst., Troy, N. Y.
EFFECT OF TITANIUM ADDITIONS ON AGING CHARACTERISTICS AND STRESS CORROSION CRACKING SUSCEPTIBILITY OF Al-Zn-Mg ALLOYS Ph.D. Thesis
Chun Chen 1977 189 p
Avail: Univ. Microfilms Order No. 77-23784

The effect of Ti additions on the microstructure in aging treatments and stress corrosion cracking (SCC) susceptibility of Al-Zn-Mg alloys was studied. The influence of aging treatment was examined for alloys with and without Ti addition. For two stage aging treatments, the alloys were solution heat treated at 510 C, air cooled, then aged at various temperatures below the G.P. zone solvus for short times before aging above the G.P. zone solvus at 200 C. The Ti addition alloy yields a small precipitate-free zone and a higher density of precipitate near the edge of the PFZ than in the mid-grain region. The ternary alloy without Ti addition produces a wide range of PFZ sizes depending upon the aging temperature below the G.P. zone solvus. Significant changes in the morphology of the matrix precipitate, the amount of grain boundary precipitate, and the width of PFZ, were observed in single stage aging at 200 C as a result of the Ti addition. Dissert. Abstr.

N78-16141 Rensselaer Polytechnic Inst., Troy, N. Y.
CORROSION FATIGUE BEHAVIOR OF COPPER AND COPPER BASE ALLOYS Ph.D. Thesis
Henry Nicholas Hahn 1977 158 p
Avail: Univ. Microfilms Order No. 77-21140

High cycle fatigue of high purity polycrystalline copper, single crystals of copper, single crystals of copper-aluminum and polycrystalline copper-nickel-chromium alloys in the aged and solutionized conditions was investigated. Specimens were tested in laboratory air, 0.5N NaCl, and 0.5N NaCl with applied anodic currents or potentials. A large decrease in life occurred when the aged copper-nickel-chromium alloy was tested in 0.5N NaCl. However, accelerated dissolution caused the same loss in life of polycrystalline copper or solutionized copper-nickel-chromium alloy. Cathodic currents restored fatigue life to that observed in air. Exposure of single crystals of copper or single crystals of copper-aluminum to a corrosive environment during fatigue results in a large increase in life. Dissert. Abstr.

N78-16142 Case Western Reserve Univ., Cleveland, Ohio.
THE STRESS CORROSION CRACKING OF MILD STEELS IN NITRATE ENVIRONMENTS Ph.D. Thesis
Orrie Steven Grimm 1977 71 p
Avail: Univ. Microfilms Order No. 77-25160

An investigation of the stress corrosion cracking of high strength 4140 steel, and low strength 1008 steel in a nitrate solution at elevated temperature, was conducted over a very broad range of potentials. The concomitant study of hydrogen permeation and polarization behavior, complemented by SEM and optical metallography were employed to help identify the mechanism of cracking. The time to fail as a function of potential curves revealed a cathodic branch in 4140. The 1008 did not exhibit a cathodic failure curve but was shown to lose considerable ductility on cathodic charging. The expected anodic failure behavior was observed in both steels. Permeation studies showed increasing H2 permeation with applied cathodic potential and no anodic permeation. Polarization of 4140 steel showed evidence for competition among hydrogen and nitrate reduction reactions which helped to explain a range of cathodic protection in this material. Dissert. Abstr.

N78-16143 Case Western Reserve Univ., Cleveland, Ohio.
PRODUCTION AND PROPERTIES OF GRAIN REFINED NICKEL BASE SUPERALLOY TURBINE COMPONENTS Ph.D. Thesis
Thomas Alan Kolakowski 1977 132 p
Avail: Univ. Microfilms Order No. 77-25170

The improvement of integrally cast turbine rotor fatigue properties was accomplished through grain refinement of the cast nickel base superalloys used to produce them. The practicality of producing grain refined integrally cast turbine rotors and the effects of grain refining on as cast stress rupture properties were examined. The possibility of improving grain refined mechanical properties further via heat treatment was also investigated. Three modern nickel base superalloys, 713LC, MAR-M 246 and C-103 were selected for initial studies and MAR-M 246 (the alloy now used commercially for these rotors) was finally cast successfully in the refined condition to produce satisfactory turbine rotors on a production melting and casting unit. Dissert. Abstr.

N78-16144 Rensselaer Polytechnic Inst., Troy, N. Y.
KINETICS AND THERMODYNAMICS OF THE MARTENSITE TRANSFORMATION IN ATHERMAL Fe-C-NiCr ALLOYS Ph.D. Thesis
Rajendra Pradhan 1977 111 p
Avail: Univ. Microfilms Order No. 77-23799

An investigation was conducted to study the martensite transformation kinetics of athermal Fe-C-Ni-Cr alloys. The transformation rate was found to be dependent on alloy composition and was a function of the rate of change of chemical free energy with temperature, and the energy expended in deforming the austenite surrounding a growing martensite embryo in order to accommodate the transformational volume and shear strains. Increasing either of the two factors leads to an increase in transformation rate. Also, it was found that the magnitude of the contribution of the deformation energy to the overall nonchemical free energy associated with the transformation depends on the alloy system and specific composition.
Dissert. Abstr.

N78-16145 Boston Coll., Chestnut Hill, Mass.
ULTRASONIC ATTENUATION, ACOUSTIC EMISSION AND MORPHOLOGICAL STUDIES OF MARTENSITIC TRANSFORMATION IN Fe-Ni ALLOYS Ph.D. Thesis
Shyh-Shyong Hsu 1977 161 p
Avail: Univ. Microfilms Order No. 77-27209

Composition of FeNi (28 to 31 wt% Ni) alloys was examined by wet chemical analysis, mass spectrographic analysis, electron microprobe, scanning electron microscopy and high magnification microscopy (1800X). Martensitic transformation in polycrystal FeNi alloys were studied by means of ultrasonic attenuation, acoustic emission and optical microscopy. Rayleigh and stochastic scattering of ultrasonic waves in FeNi polycrystals were analyzed and correlated with athermal, irreversible and reversible Martensitic transformations. Multiple attenuation peaks associated with Martensite formation were correlated with acoustic emission data. The characteristics of reversible thermoelastic Martensitic transformation below 60 C were investigated by optical microscopy and ultrasonic attenuation measurements. The optical morphology studies as a function of temperature were recorded on video tape. Dissert. Abstr.

N78-16146 Illinois Univ., Urbana-Champaign.
RAMAN SCATTERING FROM METALS Ph.D. Thesis
John Allen Holy 1977 263 p
Avail: Univ. Microfilms Order No. 26681

Raman spectra of several metallic layered transition metal

dichalcogenides in which charge density waves (CDW's) form, hydrogen and deuterium--charged Nb and Ta, and nonstoichiomry-ric TiC was studied. For the 2H polytypes of TaS2, TaSe2, and NbSe2 above the CDW transition, all four Raman-active phonons expected from their space group were observed. Force constants were calculated from the Born-von Karman model and the observed frequencies of the modes. The spectra of these metallic 2H polymorphs were characterized by an intense acoustic two phonon peak. The evolution of the Raman spectrum of 2H-TaSe2 in the superlattice of the CDW phase was measured. Intense new modes resulted from acoustic phonons along Sigma that were strongly coupled to the CDW. Dissert. Abstr.

N78-16147 State Univ. of New York, Stony Brook.
VACANCY DEFECT DYNAMICS IN QUENCHED METALS AND VACANCY PROPERTIES IN GOLD Ph.D. Thesis
Raghaba Prasada Sahu 1977 201 p
Avail: Univ. Microfilms Order No. 77-25358

Quenching and annealing of excess vacancy defects in metals were studied by using the chemical rate theory approach for a system containing mono-, di- and tri-vacancies as mobile defects. An approximate method is described to compute the frozen-in concentration of mono-, di- and tri-vacancies in a metal, provided the total vacancy concentration and the rate of quench was known. The results agreed well with the results computed from the chemical rate theory. The effective activation energy and kinetics of annealing depend on the partitioning of vacancy defects into mobile defects during annealing. It was shown that the dynamic partitioning during annealing did not, in general, obey the law of local equilibrium among the various mobile vacancy defect species. The dynamic partitioning was a function of the defect parameters as well as the sink structure.
Dissert. Abstr.

N78-16148 Wisconsin Univ., Madison.
THE INFLUENCE OF SOME METALLURGICAL VARIABLES ON THE MACHINABILITY OF POWDER METALLURGY STEELS Ph.D. Thesis
Phillip John Andersen 1977 269 p
Avail: Univ. Microfilms Order No. 77-19084

The aspects of machinability evaluated include: measurements of cutting forces while drilling with a constant feed and speed, drill life determinations, surface finish measurements, and studies of chips formed during machining. The metallurgical variables investigated include: workpiece density, workpiece composition, alterations in workpiece microstructure caused by different cooling rates from the sintering temperature, and the use of plastic impregnation. The compositional factors evaluated include the use of various carbon, sulfur, lead, and bismuth contents, as well as several other metallic and nonmetallic additions. All of the iron powders used were made by water atomization. Conventional unalloyed iron powders and low alloy hardenable iron powders were used. Dissert. Abstr.

N78-16149*# IIT Research Inst., Chicago, Ill.
THERMAL FATIGUE AND OXIDATION DATA FOR ALLOY/BRAZE COMBINATIONS Technical Report, May 1975 - May 1977
V. L. Hill and V. E. Humphreys Jun. 1977 55 p refs
(Contract NAS3-18942)
(NASA-CR-135299; IITRI-B6134-25) Avail: NTIS HC A04/MF A01 CSCL 11F

Thermal fatigue and oxidation data were obtained for 62 brazed specimens of 3 iron-, 3 nickel-, and 1 cobalt-base alloy. Fluidized bed thermal cycling was conducted over the range 740/25 C employing 10 cm long single-edge wedge specimens. Immersion time was always 4 minutes in each bed. Types of test specimens employed in the program include those with brazed overlays on the specimen radius, those butt brazed at midspan and those with a brazed foil overlay on the specimen radius. Of the 18 braze overlay specimens, 5 generated fatigue cracks by 7000 cycles. Thermal cracking of butt brazed specimens occurred exclusively through the butt braze. Of the 23 butt brazed specimens, 7 survived 11,000 thermal cycles without cracking. Only 2 of the 21 foil overlaid specimens exhibiting cracking in 7,000 cycles. Blistering of the foil did occur for 2 alloys by 500 cycles. Oxidation of the alloy/braze combination was limited at the test maximum test temperature of 740 C. Author

N78-16150*# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Metallurgy and Materials Science.
THE EFFECT OF MICROSTRUCTURE AND STRENGTH ON THE FRACTURE TOUGHNESS OF AN 18 Ni, 300 GRADE MARAGING STEEL Final Report
J. A. Psioda and J. R. Low, Jr. Nov. 1977 94 p refs
(Grant NGR-39-087-003)
(NASA-CR-135288; CMU-NASA-8) Avail: NTIS HC A05/MF A01 CSCL 11F

Fractography and metallographic sectioning were used to investigate the influence of microstructure and strength on the fracture toughness (Klc) and fracture mechanism of an 18 Ni, 300 grade maraging steel. Increased yield strength from 1442 to 2070 MN/m squared through precipitation hardening results in a Klc loss from 143 to 55 MN/m superscript 3/2. Ti (C,N) Ti2S, and TiC inclusions in sizes from 1 to 8, 1 to 15, and 0.1 to 2 microns respectively serve as sites for void nucleation and lead to fracture by the dimpled rupture process in all strength levels considered. TiC nucleated dimples occupy more than half the fracture in all conditions. Void nucleation rate and resultant number of dimples per unit area of fracture increase with increasing yield strength. Average dimple size decreases with increasing strength and/or overaging which follows from the decreasing amount of stable void growth measured by sectioning tensile specimens. Void growth is assisted by crack branching along a path of TiC inclusions. Coalescence occurs in the highest strength materials by a combination of TiC void nucleation and premature separation at strengthening precipitates. Author

N78-16151# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
HYDROGEN DIFFUSION IN STRUCTURAL STEELS IN RELATION TO FLAKE FORMATION
V. I. Yavoiskii, G. V. Guskov, V. L. Safonov, G. F. Yakovenko, S. I. Nikolaevskaya, and A. A. Ezhov 1978 24 p refs Transl. into ENGLISH from Fiz.-Khim. Issled. Protsessov Proizvod. Stali (USSR), 1973 p 38-48
(NRC/CNR-TT-1915; ISSN-0077-5606) Avail: NTIS HC A02/MF A01

A mass spectrometer and a recording potentiometer were used to determine the coefficients of diffusion, permeability and solubility of hydrogen in metals as a function of temperature. These parameters were determined for pearlitic, martensitic, iron and austentitic steels. A.R.H.

N78-16152# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
THE EFFECT OF MINOR ALLOYING ELEMENT ADDITIONS ON MECHANICAL PROPERTIES OF TITANIUM ALLOYS Final Report, 15 Dec. 1974 - 15 Dec. 1976
M. W. Mahoney, N. E. Paton, W. M. Parris, and J. A. Hall Wright-Patterson AFB, Ohio AFML May 1977 203 p refs
(Contract F33615-75-C-5089)
(AD-A046693; SC5011.25TR; AFML-TR-77-56) Avail: NTIS HC A10/MF A01 CSCL 11/6

This Technical Report describes a research program conducted jointly by the Science Center, Rockwell International, and TIMET, to study the effects of minor element additions on the mechanical properties of titanium alloys. The effect of additions of Si, Bi, Fe, S and O on mechanical properties of a base alloy of composition Ti-6Al-2Sn-2Zr-1Mo have been studied. In this Technical Report final results on tensile, creep, creep stability, alloy partitioning, fatigue, fracture, hot salt stress corrosion, and microstructural characterization of these alloys is presented. Author (GRA)

N78-16153# American Univ., Washington, D. C. Dept. of Physics.
HIGH POWER MAGNETOSTRICTIVE TRANSDUCER RARE EARTH-IRON MATERIALS Technical Report, 1976 - 1977
Earl Callen Oct. 1977 10 p refs
(Contract N00014-75-C-0736)
(AD-A046920) Avail: NTIS HC A02/MF A01 CSCL 11/6

This report covers various phenomena and related studies on the magnetostrictive properties of rare earth and iron alloys and their application toward the fabrication of a high-power magnetostrictive transducer. GRA

N78-16154# Rensselaer Polytechnic Inst., Troy, N. Y.
PREVENTION OF HYDROGEN-INDUCED CRACKING IN HY-130 WELDMENTS Technical Report, 1 Jul. 1976 - 30 Jun. 1977
W. F. Savage, E. F. Nippes, and A. J. Silvia 30 Sep. 1977 60 p refs
(Contract N00014-75-C-0944)
(AD-A047195) Avail: NTIS HC A04/MF A01 CSCL 13/5

The investigation was centered on the effect of preheat and postheat treatments on the hydrogen content and initiation and propagation of hydrogen-induced cracks in HY-130 weldments. The initiation and propagation of cracks in welds deposited using both the GMA and SMA processes were studied by the augmented strain cracking test (ASC test). The weld metal hydrogen contents for the various weld beads were determined by the BWRA/IIW technique. Cracking was found to depend on the base material, augmented strain, hydrogen content, and weld energy input used, but the relationships among these variables are complex. The measured hydrogen contents of the deposited welds were found to depend on the weld energy input, the bead size, and the preheat and postheat treatments. It was found that hydrogen-induced cracking was nucleated predominately along grain boundaries within the weld metal. However, some cracking was observed to be associated with elongated nonmetallic inclusions in the partially melted zone and the true heat-affected zone. Author (GRA)

N78-16155# Oak Ridge National Lab., Tenn.
USE OF A MODIFIED BEAM IN OBTAINING CREEP DATA IN UNIAXIAL TENSION AND COMPRESSION
D. N. Robinson, R. L. Battiste, and M. Richardson 1977 15 p Presented at 4th Intern. Conf. on Structural Mechan. in Reactor Technol., San Francisco, 15 Aug. 1977
(Contract W-7405-eng-26)
(CONF-770807-8) Avail: NTIS HC A02/MF A01

The technique avoids most of the difficult alignment problems associated with conventional uniaxial testing compression. Application of the method is made to 2-1/4 Cr-1 Mo steel, a primary reactor system metal. It is concluded that the elastic-creep behavior of this alloy is effectively the same in compression as in tension. Moreover, the slotted beam is judged a practicable tool for obtaining reliable creep data in tension and compression. ERA

N78-16156# Notre Dame Univ., Ind. Dept. of Metallurgical Engineering and Materials Science.
MICROSTRUCTURAL EFFECTS IN ABRASIVE WEAR Quarterly Progress Report, 15 Mar. - 15 Jun. 1977
N. F. Fiore 1 Jul. 1977 14 p
(Contract EF-77-S-02-4246)
(COO-4246-1) Avail: NTIS HC A02/MF A01

Correlation of the microstructural features of alloy cast irons and Co-base alloys to their wear resistance under room temperature low stress and high stress (gouging) abrasion is discussed. Low stress abrasion resistance was determined on a dry sand, rubber wheel device, whereas high stress abrasion resistance was measured in a grinding wheel test. The microstructures of the test materials were characterized by automated image analysis techniques. ERA

N78-16157# Oak Ridge National Lab., Tenn.
CREEP AND RUPTURE BEHAVIOR OF A BAINITIC (NORMALIZED AND TEMPERED) 2 1/4 Cr-1 Mo STEEL
R. L. Klueh Jul. 1977 30 p refs
(Contract W-7405-eng-26)
(ORNL-5273) Avail: NTIS HC A03/MF A01

The creep-rupture behavior of a normalized and tempered 2-1/4 Cr-1 Mo steel was determined at 454, 510, and 566 C. Tests were made on specimens taken from a commercial heat of steel where the microstructure was completely bainitic. In addition to the creep-rupture behavior, secondary and tertiary creep behavior were also examined. A relationship between the onset of tertiary creep and rupture life was obtained. The results from these tests were compared with available data on annealed, normalized and tempered, and quenched and tempered base metal and with tempered weld metal. The results of these comparisons gave insights into the types of precipitation reactions that occur in 2-1/4 Cr-1 Mo steel. ERA

N78-16158# Sandia Labs., Albuquerque, N. Mex.
ION IMPLANTATION IN METALS
F. L. Vook Feb. 1977 23 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0373) Avail: NTIS HC A02/MF A01

Some of the recent advances in the modification and study of the basic properties of metals by ion implantation techniques are reported. Most of the research illustrated some of the new and exciting applications of ion beams to metals which were under active investigation. ERA

N78-16159# Sandia Labs., Albuquerque, N. Mex.
HIGH PRESSURE MULTIPLE SHOCK RESPONSE OF ALUMINUM
R. J. Lawrence and J. R. Asay 1977 20 p refs Presented at 6th AIRAPT Intern. High-Pressure Conf., Boulder, Colo., 25 Jul. 1977
(Contract EY-76-C-04-0789)
(SAND-77-0027C; Conf-770706-16) Avail: NTIS HC A02/MF A01

It is known that both dynamic yield strength and rate-dependent material response exert direct influence on the development of surface and interface instabilities under conditions of strong shock loading. A detailed understanding of these phenomena is therefore an important aspect of the analysis of dynamic inertial confinement techniques which are being used in such applications as the generation of controlled thermonuclear fusion. In these types of applications, the surfaces and interfaces under considerations can be subjected to cyclic loading characterized by shock pressures on the order of 100 GPa or more. It becomes important to understand how rate effects and material strength differ from the values observed in the low pressure regime where they are usually measured, as well as how they are altered by the loading history. ERA

N78-16160# Argonne National Lab., Ill.
EQUATIONS OF STATE FOR ALKALI METALS NEAR THEIR CRITICAL POINTS
M. Blander and H. R. Leribaux 1977 16 p refs Presented at 7th Symp. on Thermophysical Properties, Gaithersburg, Md., 10 May 1977
(Contract W-31-109-eng-38)
(CONF-770537-4) Avail: NTIS HC A02/MF A01

Equations of state of alkali metals which provide a good representation of the thermodynamic properties of alkali metals, especially up to their critical temperatures and beyond, and also have a form consistent with quantum mechanical theory, are discussed. ERA

N78-16161# Brookhaven National Lab., Upton, N. Y.
INFLUENCE OF TENSILE STRESSES ON THE SUPERCONDUCTING TEMPERATURE OF MULTIFILAMENTARY N63Sn COMPOSITE CONDUCTORS
T. Luhman, M. Suenaga, and C. J. Klamut 1977 17 p refs Presented at Cryogenic Engineering Conf., Boulder, Colo., 2 Aug. 1977
(Contract EY-76-C-02-0016)
(BNL-23016; Conf-770801-15) Avail: NTIS HC A02/MF A01

The need for Nb3Sn multifilament conductors in large magnet systems has generated interest in the mechanical and associated electrical properties of these composites. The superconducting compound (Nb3Sn) in bronze processed conductors was subjected to a compressive strain originating from thermal contraction of the outer bronze matrix. Such compressive strains lower the compound's superconducting temperature, T/sub c/ and critical current density, J/sub c/, while removal of the compressive strains by etching off the bronze matrix restores T/sub c/ and J/sub c/. A study is presented of T/sub c/ and its relationship to both internal prestrains and applied tensile loads at 4.2 K in these composite superconductors. ERA

N78-16162# Brown Univ., Providence, R. I. Div. of Engineering.
SEGREGATION INDUCED EMBRITTLEMENT OF GRAIN INTERFACES
D. D. Mason May 1977 41 p refs
(Contract EY-76-S-02-3084)

(COO-3084-52) Avail: NTIS HC A03/MF A01

Conditions are discussed under which an interface, possibly containing an adsorbed species, is capable of sustaining an atomistically sharp cleavage crack, rather than having any such crack blunt out via dislocation nucleation. Two models for ductile versus brittle interface response are discussed. One of these is applied to model grain boundaries in face centered cubic materials, and is used to compare predictions with experimental observations on the embrittlement of Cu polycrystals by the addition of dilute concentrations of Bi. The general results are in qualitative agreement, although the model predicts behavior that is, in general, more ductile than that observed experimentally. An analysis of the work of reversible separation of an interface containing a segregated species is appended. This is intended to clarify some issues recently raised in the literature on interfacial embrittlement, especially concerning the distinctions that must be drawn between expressions for cohesive energy reductions for interfacial separation at constant chemical potential, versus separation with constant concentration of the adsorbate species. ERA

N78-16163# California Univ., Berkeley. Lawrence Berkeley Lab.

KINETICS OF FORMATION OF THE A-15 PHASE IN THE Nb-Al-Ge SYSTEM M.S. Thesis

E. Kannatey-Asibu, Jr. May 1977 46 p refs

(Contract W-7405-eng-48)

(LBL-6266) Avail: NTIS HC A03/MF A01

The time and temperature dependence of the growth of the A-15 phase and its grains in the Nb-Al-Ge system were studied. In addition, changes in the microstructure and composition of the A-15 phase were studied, using an EDAX analysis. The data were plotted and compared with theory. The results were used to explain the variations in the superconducting properties of this system as observed in earlier work. Consequently, areas for further study towards optimizing the superconducting parameters of this system were proposed. ERA

N78-16164# California Univ., Berkeley. Lawrence Berkeley Lab.

EFFECT OF SILICON ON THE ENVIRONMENTAL CRACKING BEHAVIOR OF A HIGH STRENGTH STEEL Ph.D. Thesis

M. H. C. Cedeno May 1977 68 p refs

(Contract W-7405-eng-48)

(LBL-6012) Avail: NTIS HC A04/MF A01

The effect of silicon on the environmental cracking behavior of high strength steels was investigated by testing AISI 4340 and 300-M steels in various environments. Results show that, whether it was used as an austenite stabilizer or as a solid solution strengthener, silicon reduced steady-state crack velocities by substantial amounts. Lifetimes, however, appear to depend more on fracture toughness than on any other parameter. The present work has confirmed that the environmental cracking behavior of a material can be modified by composition and heat treatment variation; therefore, the possiblity of designing environmental cracking-resistant alloys should be explored further. ERA

N78-16165# California Univ., Berkeley. Lawrence Berkeley Lab.

STUDIES OF DESIGN PARAMETERS IN THE FABRICATION OF Nb-Al-Ge SUPERCONDUCTORS BY THE POWER METALLURGY INFILTRATION METHOD Ph.D. Thesis

J. J. Granda Dec. 1976 68 p refs

(Contract W-7405-eng-48)

(LBL-5772) Avail: NTIS HC A04/MF A01

Experimental studies were carried out in which the A15 phase of the Nb-Al-Ge system was synthesized in the form of thin filaments contained in form rolled wires. A powder metallurgy approach was used to achieve controlled porosity in compacts of sintered niobium powder. Infiltration with an aluminum-germanium eutectic alloy followed by mechanical deformation has produced small interconnected filaments embedded in the Nb matrix. Diffusion heat treatment for a short time transforms them into the A15 superconducting compound with a size range of 1-5 microns at 1300 C and 1-9 microns at 1750 C. The superconducting properties T/sub c/ and J/sub c/ were evaluated for samples subjected to different condition of time and temperature. The influence of certain parameters involved in the process was investigated. The microstructure and microhardness of the Al-Ge eutectic alloy cooled at high and low cooling rates from temperatures between 900-400 C have been evaluated. ERA

N78-16166# California Univ., Livermore. Lawrence Livermore Lab.

RESPONSE OF POROUS BERYLLIUM TO STATIC AND DYNAMIC LOADING

W. M. Isbell, O. R. Walton, and F. H. Ree Jul. 1977 26 p refs Presented at 6th AIRAPT Intern. High-Pressure Conf., Boulder, Colo., 25-26 Jul. 1977

(Contract W-7405-eng-48)

(UCRL-79712; Conf-770706-17) Avail: NTIS HC A03/MF A01

Previous investigations of the mechanical response of porous materials to dynamic loading were extended to include the shock wave response of a brittle metal. The complex response of berylliums of 85 to 90 percent porosity in two initial conditions was examined in a theoretical and experimental program. The study has resulted in the development of constitutive relations placed in hydrocodes which are capable of accurately predicting wave propagation in the berylliums. A comprehensive set of static (0 to 4 Gpa) and dynamic (0 to 35 Gpa) experiments was performed to measure the behavior of these brittle, porous materials to imposed loads. The results of the experiments guided a modeling effort which added several new features to previous models, including deviatoric stresses, porosity-dependent relaxation time of pore closure, elastic-plastic reopening of pores, and improved compaction functions. ERA

N78-16167# Boeing Commercial Airplane Co., Seattle, Wash.

REGENERATION OF CHROMATED ALUMINUM DEOXIDIZERS. IMPROVED DIAPHRAGM FABRICATION AND PERFORMANCE Final Report, Nov. 1973 - Oct. 1975

Harry C. Hicks and Donald F. Sekits Sep. 1977 40 p refs (Grant EPA-S-803064)

(PB-272687/5; D6-22251-16; EPA-600/2-77-194) Avail: NTIS HC A03/MF A01 CSCL 11F

A regeneration process was conceived and tested to reduce the frequency of discarding the spent chromated deoxidizers. The engineering techniques developped involve reoxidation of trivalent chromium to the hexavalent state by electrolysis through a diaphragm plus removal of undesirable dissolved metals by crystallization and separation. Results establish that regeneration of chromated aluminum deoxidizers is feasible, practical and economical. Diaphragm fabrication techniques were refined to produce an improved diaphragm in terms of cost and performance. In addition, electrolytic regeneration equipment installed in a large production tank for six months exceeded technical and economic objectives. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N78-16168 Case Western Reserve Univ., Cleveland, Ohio.

THE ASSESSMENT OF SEQUENCE DISTRIBUTION-PROPERTY RELATIONSHIPS IN SELECTED ACRYLONITRILE COPOLYMER SYSTEMS Ph.D. Thesis

Thomas Andrew Gerken 1977 211 p

Avail: Univ. Microfilms Order No. 77-25157

The initial analysis of the microstructure of a series of acrylonitrile copolymers by carbon-13NMR is presented. Carbon-13 spectra are shown for a series of acrylonitrile copolymers with methyl methacrylate, ethylmethacrylate, methacrylamide, alpha methylstyrene, methacrylonitrile, and acrylamide. The strategy of assigning carbons that are sensitive to sequence and tacticity is discussed. Triad sequences and in many instances triad tacticities were assigned to the alpha functional carbons, i.e., the nitrile, carbonyl, and phenyl C-1. The methine and methylene carbons, in copolymers where the comonomer has an alpha methyl were easily assigned to triad, and dyad and/or

tetrad sequences respectively. Methods are shown enabling the direct determination of monomer reactivity ratios from the C-13 spectra and sequence calculations are shown to confirm the sequence assignments. Dissert. Abstr.

N78-16169 Akron Univ., Ohio.
BLOCK COPOLYMERS OBTAINED BY FREE RADICAL MECHANISM Ph.D. Thesis
Lee-Pei-Henry Chou 1977 204 p
Avail: Univ. Microfilms Order No. 77-23660

Block copolymers were synthesized using styrene and methyl methacrylate as the monomers and multifunctional initiator, di-t-butyl-t-4,4'-azobisiso-(4-cyanoperoxyvalerate). The unique feature of this sequential initiator is the fact that the formation of the free radicals can be achieved thermally and/or by a redox system at different stages. The polymerizations for the formation of the block copolymer were carried out in two stages. First, a polymeric initiator, the so-called polystyrene precursor was synthesized, which was then used in the second stage to initiate methyl methacrylate polymerization. A selective solvent fractionation system was used for the separation of the block from the homopolymers. The separation technique was found to be efficient giving pure block copolymers which could subsequently be characterized by gel permeation chromatography, nuclear magnetic resonance, infrared, and electron microscopy techniques.
Dissert. Abstr.

N78-16170 North Dakota State Univ., Fargo.
PHOTOSTABILIZATION OF COATINGS: STUDIES ON RESONANCE ENERGY TRANSFER Ph.D. Thesis
Ellis Leigh Breskman 1976 168 p
Avail: Univ. Microfilms Order No. 77-24850

Fluorescence studies on aromatic epoxy and urethane coatings (based on bisphenol A and toluene diisocyanate, respectively) suggest that the class of commercial stabilizers, the o-hydroxybenzophenones, photostabilize these coatings, against yellowing, by a combination of light screening and non radiative energy transfer. The mechanism of the non radiative energy transfer, observed in films of these coatings, appears to be resonance energy transfer. The fluorescence intensity of the epoxy and urethane films, upon exposure to light, undergoes a rapid irreversible decrease, an observation of potential importance to early detection of weatherability. Several attempts aimed at improving the stabilization effectiveness of the o-hydroxbenzophenones were also carried out. Dissert. Abstr.

N78-16171 University of Southern Mississippi, Hattiesburg.
INVESTIGATIONS OF THE EFFECTS OF SHEAR DEGRADATION ON THE RHEOLOGICAL BEHAVIOR OF ULTRA-HIGH MOLECULAR WEIGHT WATER SOLUBLE POLYMERS AS APPLIED TO ENHANCE OIL RECOVERY Ph.D. Thesis
Donald Edward McLemore 1977 164 p
Avail: Univ. Microfilms Order No. 77-22881

Characterization methods for water soluble polymers were developed. Structure property relationships were established and the effects of shear degradation on mobility control were evaluated. Polymers employed in the investigation included polyacrylamide, hydrolyzed polyacrylamides (24%, 34%, 37%) (HPAM), crosslinked HPAM, and xanthamonas polysaccharide. In the area of characterization techniques, a clarification procedure for use with light scattering molecular weight determinations was discussed and Zimm plots illustrate the usefulness of the method for salt free and salt containing aqueous polymer solutions. An aqueous exclusion chromatographic system was developed to provide more rapid analysis of polymer molecular weights and molecular weight distributions. Controlled porosity glasses were used as column packings, and polystrene sulfonates were prepared and used as calibrants. Dissert. Abstr.

N78-16172 Case Western Reserve Univ., Cleveland, Ohio.
AMORPHOUS LINEAR POLYETHYLENE Ph.D. Thesis
Janice Elizabeth Breedon Jones 1977 118 p
Avail: Univ. Microfilms Order No. 77-25166

A novel quench method was developed which is capable of quenching thin (100 - 1000 A) linear polyethylene films to an apparently amorphous state. The quench method uses a B-B gun to shoot a molten sample into a mixture of liquid and solid nitrogen. Electron microscopy of samples kept at liquid nitrogen temperature before and during platinum-carbon shadowing indicated that the glass has a morphology consisting of nodules approximately 100 A in size superimposed upon irregularities 1000 A or more in diameter. This morphology did not rearrange to form lamellae as the sample was warmed and crystallized; instead the chains seemed to reorganize locally to develop three-dimensional crystallinity. In most of the quenched samples, some localized areas of varying sizes and numbers were seen, which had lamellar or spherulitic morphology that seemed to have formed during cooling due to local variations in the quench quality. Dissert. Abstr.

N78-16173 Case Western Reserve Univ., Cleveland, Ohio.
FOURIER TRANSFORM INFRARED SPECTROSCOPIC STUDIES OF GLASS/MATRIX INTERFACE Ph.D. Thesis
Hatsuo Ishida 1977 190 p
Avail: Univ. Microfilms Order No. 77-18827

Quantitative as well as qualitative studies on the interfacial properties of a glass composite material were made, utilizing Fourier transform infrared spectroscopy (FT-IR). Special attention was focused on SiOH and SiOSi groups which reveal the structural changes of the glass surface and the silane coupling agent at the fiber/matrix interface. Band assignments of the infrared and Raman modes of vinylsilanetriol, phenylsilanetriol and their deuteroderivatives were made. Full range infrared and Raman spectra of the aqueous solutions of the vinyl- and phenylsilanetriol and crystalline phenylsilanetriol are reported. The digital subtraction technique of FT-IR was demonstrated to be extremely useful for studying the aqueous solutions of silane which display strong interference of water. Dissert. Abstr.

N78-16174 Missouri Univ., Rolla.
GLASS FORMATION, STRUCTURE AND ELECTRICAL PROPERTIES OF GLASSES IN THE Ag-AsSe SYSTEM Ph.D. Thesis
Pradip Dhirajlal Patel 1977 160 p
Avail: Univ. Microfilms Order No. 77-23693

Six different zones were identified in the glass region, based on their thermal properties, such as the glass transition temperatures, crystallization temperatures, and the Ag-As-Se phase diagrams. The structural models for glasses of each zone were proposed. Thermal properties were successfully correlated with the structural models and with the corresponding crystal structure of trechmannite (or smithite) AgAsS2(Se) and proustite (or xanthoconite) Ag3AsS3(Se) compounds. The ac conductivity, dielectric constant, and dielectric loss are measured for the selected glasses along As2Se3-Ag2Se section. With the introduction of up to 2 at.% Ag, the ac conductivity and dielectric constant of As2Se3 glasses were found to increase significantly. At approximately 5 at.% Ag, micro-crystalline AgAsSe2 phase was found to formed in a As2Se3 glass matrix which caused sharp increase in ac conductivity and dielectric constant.
Dissert. Abstr.

N78-16175 University of Southern Mississippi, Hattiesburg.
CONTROLLED POLYMERIZATION OF ACRYLAMIDE TO PRODUCE COPOLYMERS WITH UNIQUE SOLUTION AND VISCOSITY PROPERTIES Ph.D. Thesis
Thomas Chung-li Shen 1977 138 p
Avail: Univ. Microfilms Order No. 77-22891

Water-soluble polymers were synthesized and their rheological properties studied. Ultrahigh molecular weight polyacrylamide was synthesized, using gel techniques at low temperature. Chain transfer to polymer was indicated by the observed increase in value of the Huggins constant, k'. The upper limit of the chain linearity was observed to be at an intrinsic viscosity value of 23. Polymerization kinetics were studied for the sodium acrylate monomer system. A mechanism based on charge-charge repulsion was proposed to explain the observed slow reaction rate. Copolymers of acrylamide with acrylates and their derivatives were synthesized. Higher viscosities were observed at higher percentages of acrylamide in the feed. The comonomer diluted the hydrogen bonding forces yielding copolymers with lower viscosities and less shear sensitivity. Dissert. Abstr.

N78-16176 Akron Univ., Ohio.
EFFECTS OF SURFACE TREATMENTS OF GLASS ON THE STRENGTH OF ELASTOMER-GLASS ADHESION

Ph.D. Thesis
Sean Giap Wong 1977 134 p
Avail: Univ. Microfilms Order No. 77-23455

The strength of adhesion of various elastomers, crosslinked in situ by a free-radical process, to Pyrex and quartz substrates was studied. The strength of elastomer-glass adhesion was found to be consistent with the WLF rate-temperature equivalence principle, and to increase with decrease in the degree of crosslinking of the elastomer. It was observed that the joint strength obtained was affected by both the etching agent used to clean the glass plate after use and the method of rinsing the etched plate. Rinsing by Soxhlet extraction with distilled water gave significantly better reproducibility and lower peel strength compared to rinsing in flowing tap distilled water which resulted in contaminated plates. Scanning electron micrographs showed that etched glass plates giving the higher level of peel strength contained gross surface contamination, presumably residual rubber unremoved by the etching treatment. Dissert. Abstr.

N78-16177 Drexel Univ., Philadelphia, Pa.
SELECTIVE PAINTS FOR SOLAR ABSORBERS Ph.D. Thesis
Janon Frederic Embury, Jr. 1977 140 p
Avail: Univ. Microfilms Order No. 77-23422

A theoretical investigation into the solar absorptance and infrared emittance of hypothetical black paints with pigment particle size in the Rayleigh region is carried out using radiative transfer theory. The influence of a number of factors on paint selectivity is determined; namely, specular and diffuse reflecting interfaces, absence of an interface, metal substrate reflectance, single scatter albedo, and optical depth at solar and infrared wavelengths. Improvements in selectivity are predicted and the extent of selectivity improvements are calculated which result from a glossy paint air interface, a diffuse reflecting substrate, low albedo values, intermediate optical depths, a selective metal substrate and lower ratios of IR optical depth over solar optical depth. An experiment was undertaken to evaluate the solar selective properties of black paints which can be inexpensively formulated from commercially available black pigments.
Dissert. Abstr.

N78-16178 Case Western Reserve Univ., Cleveland, Ohio.
A CONTINUUM MODEL FOR THE PREDICTION OF THERMODYNAMIC PROPERTIES IN SIMPLE POLYMERS Ph.D. Thesis
Frederick Philip Boyle 1977 157 p
Avail: Univ. Microfilms Order No. 77-25141

A model is presented which treats the torsional angles about bonds connecting monomer units in a polymer as continuous variables. Intrachain interactions are taken only between nearest neighbors, the interchain interactions are treated in a generalized mean-field expansion which starts from a detailed energetics of a pair of parallel and adjacent chain segments, and the hard variables and kinetic energies of the intrachain problem and the relative positions and kinetic energies of the interchain problem are included in terms of the phonons of the system. A formalism is described whereby the Helmholtz energy of the model is found by solution of a set of self-consistent integral and transfer integral equations involving functional of the distribution of torsional angles, and the interchain separation. Due to the difficulty of applying this exact formalism with integral equations to real polymers, two different methods of simplifying the problem are also presented.
Dissert. Abstr.

N78-16179 Rensselaer Polytechnic Inst., Troy, N. Y.
ATMOSPHERIC GAS CONCENTRATIONS IN POLYMERS Ph.D. Thesis
Michael Anthony Centanni 1977 85 p
Avail: Univ. Microfilms Order No. 77-23783

Paramagnetic oxygen molecules, present as impurities, were detected by pulsed nuclear magnetic resonance techniques, magnetic susceptibility measurements, and mass measurements in polystyrene, linear polyethylene, and branched polyethylene. The spin-lattice relaxation time (T1) of the protons in the polymers changes from about one second to hundreds of seconds when oxygen is removed from the samples by gentle baking in a vacuum. The baked samples are subsequently exposed to air for certain intervals of time, and then T1 is again determined. This technique yielded information concerning the relative rates at which molecular oxygen diffuses into the three polymers. In fact, molecular oxygen is seen to diffuse much more rapidly into the two polyethylene samples than into the polystyrene sample. Magnetic susceptibility measurements were performed to determine the concentration of molecular oxygen in these polymers. Dissert. Abstr.

N78-16180 Utah Univ., Salt Lake City.
DYNAMIC RELAXATION BEHAVIOR OF STEREOREGULAR HYDROPHILIC METHACRYLATE POLYMERS Ph.D. Thesis
Geoffrey Andrew Russell 1977 179 p
Avail: Univ. Microfilms Order No. 77-23100

Polymers were prepared using 2-hydroxyethyl methacrylate or 2-methoxyethyl methacrylate as starting materials. The stereochemical configuration (tacticity) was controlled for each polymer by selection of catalyst system and polymerization conditions. The resulting polymers ranged from highly isotactic materials to highly syndiotactic materials. The tacticity of each polymer was determined by integration of its spectrum. Topics discussed include the mechanical relaxation of each polymer observed at about 1 Hz from 77 K to 400 K using a freely oscillating torsion pendulum; and the dielectric relaxation for each sample from 77 K to 325 K for four frequencies (10 Hz, 100 Hz, 1KHz, and 10 KHz) using a parallel plate cell and precision capacitance bridge. Dissert. Abstr.

N78-16181 Massachusetts Univ., Amherst.
SMALL ANGLE X-RAY SCATTERING STUDIES OF THE DEFORMATION OF POLYETHYLENE Ph.D. Thesis
Stanley K. Baczek 1977 348 p
Avail: Univ. Microfilms Order No. 77-26409

Intensities from uniaxially strained (90%) low density polyethylene (LDPE), and (25%) high density polyethylene, and (40%) special texture (parallel lamellae stretched perpendicular to lamellar planes) LDPE were analyzed at specific azimuthal angles, reflecting angular positions within the spherulites, by assuming the linear paracrystalline Hosemann scheme. Results indicate onset of fiber formation or microscopic yielding long before any macroscopic effects are observed. Lamellar orientation functions were calculated and compared to various model predictions. Effects of lamellar twisting and c-axis chain tilting were considered. A mechanism of lamellar buckling and interleaving for those perpendicular to the stretch direction was proposed while amorphous compression and interlamellar slip for those lamellae parallel to the strain was advanced. Dissert. Abstr.

N78-16182 Washington Univ., Seattle.
AN INVESTIGATION OF THE ELASTIC FREE ENERGY OF POLYMER NETWORKS BY VAPOR SORPTION Ph.D. Thesis
Larry Yin-Kit Yen 1977 107 p
Avail: Univ. Microfilms Order No. 77-26882

The elastic component of the solvent chemical potential in isotropically swollen polymer networks was investigated, as a function of the degree of dilation. The experimental method involved measurement of the differential sorption of solvent vapor by crosslinked and uncrossedlinked polymers of the same kind as a function of solvent activity. This experiment was similar to one employed by Gee, Herbert and Roberts in their investigation of the elastic properties of a natural rubber network swollen with benzene. A refinement of Gee and coworkers' procedure was made by measuring the integral sorption of solvent vapor by the uncrosslinked polymer in parallel with the differential sorption. This minimized uncertainties in the chemical potential change due to mixing of polymer with solvent. Three systems were investigated: Poly(dimethylsiloxane)benzene, poly(styrene-co-butadiene)-benzene and poly(styrene-co-butadiene)-n-heptane.
Dissert. Abstr.

N78-16183 Rochester Univ., N. Y.
MECHANICAL DEGRADATION OF POLYMERS Ph.D. Thesis
Dilipkumar Gendmal Padliya 1976 212 p
Avail: Univ. Microfilms Order No. 77-25474

A theoretical development and experimental investigation mechanical degradation of polymers is described. Three kinetic

rate expressions for mechanical degradation were proposed. All the three expressions exhibited the dependence of the rate of degradation on shear stress, a decrease in the rate of degradation as the degradation proceeds, a critical shear stress for an initial molecular weight below which no degradation takes place, and a limiting molecular weight with degradation at a fixed shear stress. One of the three expressions was similar to the kinetic rate expression for a first order chemical reaction and the other two were logical extension. Using these rate expressions, equations were then developed to predict the molecular weight distribution of a polymer after it was sheared in both a uniform shear stress field and in the variable shear stress field of a capillary.
Dissert. Abstr.

N78-16184 Stevens Inst. of Tech., Hoboken, N. J.
NON-ISOTHERMAL BEHAVIOR AND THERMAL RUNAWAY PHENOMENA IN CHAIN-ADDITION COPOLYMERIZATIONS Ph.D. Thesis
Donald Hugh Sebastian 1977 323 p
Avail: Univ. Microfilms Order No. 77-26950

The non-isothermal behavior of chain addition copolymerizations can be predicted from appropriate dimensionless parameter groupings. A semi-analytic approach was used to develop expressions for time constants for copolymerization. These time constants were combined to form dimensionless groupings characterizing reaction behavior. Their utility was verified through numerical simulation and experimental tests. The styrene-acrylonitrile co-monomer pair was used for evaluation of the runaway criteria. Dissert. Abstr.

N78-16185 Washington Univ., Seattle.
A NUMERICAL PROJECTIVE METHOD FOR STRESS ANALYSIS OF ANISOTROPIC MATERIALS WITH SPECIAL REFERENCE TO CERAMIC CRYSTALS Ph.D. Thesis
Girindra Kumar Das 1977 362 p
Avail: Univ. Microfilms Order No. 77-26812

A numerical solution procedure for three-dimensional equilibrium problems in linear thermoelasticity was developed for homogeneous anisotropic bodies based on a direct projective formulation. Results are presented for several problems showing the validity and the application of the method. Using the projective method, the linear differential equations of the anisotropic thermoelasticity are transformed into a finite system of approximating linear algebraic equations by making certain projections. The projections themselves follow certain conditions in such a way that the fulfillment of those conditions automatically assures the convergence of the approximate solution. In general, projections which are regular and have totally bounded norms fulfill these conditions. In addition, the functions appearing in the approximate representation need to form a complete set and fulfill the requirements of relative completeness.
Dissert. Abstr.

N78-16186*# National Aeronautics and Space Administration, Washington, D. C.
STUDY OF THE LUBRICANT PROPERTIES OF CARBON NONFLUORIDE: (CF SUBx) SUBn
D. Play and M. Godet Dec. 1977 18 p refs Transl. into ENGLISH from Colloq. Intern. du C.N.R.S. (France), no. 233-Polymers et Lubrification p 441-450
(NASA-TM-75191) Avail: NTIS HC A02/MF A01 CSCL 11H

Friction and wear tests were performed with rubbed carbon monofluorides derived from different types of carbon. Best results were given by fluorated artificial graphite and coke. The coefficient of friction is practically independent of the fluorine-to-carbon ratio x where $0 < x < 1$, but wear decreases by a factor of 6 as x tends toward 1. For a range of variation of the severity factor (PV) expressed in Newtons/cm. sec (where P is the average pressure and V the velocity) contained between 1,000 and 200,000, the wear measured with carbon monofluoride is significantly lower than that obtained with MoS2. A transfer film or third body which protects the surfaces is formed with carbon monofluoride, and beyond 400 C, thick and fragile oxide coatings are also formed. Author

N78-16187*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOLVENTLESS LARC-160 POLYIMIDE MATRIX RESIN
Terry L. StClair and Robert A. Jewell 1978 9 p refs To be presented at the 23d Natl. SAMPE Symp., Anaheim, Calif., 2-4 May 1978
(NASA-TM-74994) Avail: NTIS HC A02/MF A01 CSCL 11G

The addition polyimide, LARC-160, which was originally synthesized from low cost liquid monomers as a laminating resin in ethanol, was prepared as a solventless, high viscosity, neat liquid resin. The resin was processed by hot-melt coating techniques into graphite prepreg with excellent tack and drape. Comparable data on graphite reinforced laminates made from solvent-coated and various hot-melt coated prepreg were generated. LARC-160, because of its liquid nature, can be easily autoclave processed to produce low void laminates. Liquid chromatographic fingerprints indicate good reaction control on resin scale ups. Minor changes in monomer ratios were also made to improve the thermal aging performance of graphite laminates. Author

N78-16188*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HIGH TEMPERATURE ADHESIVES FOR BONDING KAPTON
Anne K. StClair, Wayne S. Slemp, and Terry L. StClair 1978 15 p refs To be presented at 23d Natl. SAMPE Symp., Anaheim, Calif., 2-4 May 1978
(NASA-TM-74997) Avail: NTIS HC A02/MF A01 CSCL 11A

Experimental polyimide resins were developed and evaluated as potential high temperature adhesives for bonding Kapton polyimide film. Lap shear strengths of Kapton/Kapton bonds were obtained as a function of test temperature, adherend thickness, and long term aging at 575K (575 F) in vacuum. Glass transition temperatures of the polyimide/Kapton bondlines were monitored by thermomechanical analysis. Author

N78-16189*# Celanese Research Co., Summit, N.J.
ULTRALOW DENIER POLYBENZIMIDAZOLE (PBI) YARNS Final Report, Mar. - Oct. 1977
Marshall Tan and Joseph R. Leal Oct. 1977 37 p ref
(Contract NAS2-9575)
(NASA-CR-152057) Avail: NTIS HC A03/MF A01 CSCL 11E

A study to determine the feasibility of preparing ultralow denier polybenzimidazole (PBI) yarns was undertaken. Conditions that presently yield multifilament yarns with bundle deniers ranging from 75 to 15,000 were used as a baseline. From this starting point, process parameters were identified that give five filament yarns with yarn densiers as low as 0.80. Physical properties from such ultralow denier yarns were at levels that would permit subsequent fabrication into fabrics. Author

N78-16190# Goodyear Aerospace Corp., Litchfield Park, Ariz. Arizona Div.
GLASS/PLASTIC TRANSPARENT ARMOR FOR UH-1 HELICOPTER Final Report, Oct. 1976 - Jul. 1977
Wilson C. McDonald Oct. 1977 58 p
(Contract DAAG46-76-C-0070)
(AD-A047323; GERA-2274; AMMRC-CTR-77-27) Avail: NTIS HC A04/MF A01 CSCL 01/3

The program is a continuation of the armor work previously conducted for the first time incorporated significant amounts of high-performance glass/plastic laminated armor in an aircraft. During this earlier program, certain deficiencies in materials and processing were identified which required additional work to resolve. This new effort has attempted to solve these problems while scaling up to a higher threat level. The program was divided into two phases. The first phase included the fabrication of three shipsets of scaled-up, full-size UH-1 windshields. Phase II includes the installation of two sets of windshields on test aircraft at two separate locations in the United States. GRA

N78-16191# Southwest Research Inst., San Antonio, Tex.
LONG-TERM WEAR AND IMMERSION TESTS OF POLYMERIC COATINGS Final Report, 30 Jan. 1976 - 1 Apr. 1977
R. D. Brown and D. L. Behmke 23 Nov. 1977 40 p
(Contract N68335-76-M-1629)
(AD-A047270; NAEC-ENG-7934) Avail: NTIS HC A03/MF A01 CSCL 11/3

This report describes an evaluation of four polymeric coatings, applied over AISI 4130 steel, subjected to conditions simulating those occurring in catapult accumulators used on Navy aircraft carriers. Both wear and immersion specimens were exposed to MIL-H-22072 Hydraulic Fluid which was heated to 160 F eight hours per day, five days per week for six months. Duplicate tests of each type were run. The wear (ring) specimens were also subjected to reciprocating sliding motion against bronze block specimens under an eight-lb load. Evaluation criteria included coating wear life expressed as hours of sliding or sliding distance and corrosion resistance based on microscopic examinations of the immersion specimens. GRA

N78-16192# Army Natick Research and Development Command, Mass.
EFFECT OF NONUNIFORM YARN LENGTHS ON THE STRENGTH OF PRESSURIZED FABRIC TUBES
Earl C. Steeves May 1977 31 p
(AD-A046960; Natick/TR-77/010) Avail: NTIS HC A03/MF A01 CSCL 11/5

An analysis of the load-deformation behavior and strength of pressurized fabric tubes having unequal yarn lengths is presented. This analysis models the loading of such a fabric by consideration of a series of axial members of unequal length and assumes a linear load-deformation behavior of the yarns. To obtain results the unequal lengths are chosen to be some mean length plus a randomly distributed variation about this mean. Using a normal distribution for the lengths, a computer simulation is used to compute the statistics of the failure load for fabrics having yarn lengths specified by the mean and standard deviation. These results show that significant strength reductions are possible as a result of weaving inaccuracies which result in yarns of unequal length. Author (GRA)

N78-16193# Akron Univ., Ohio. Inst. of Polymer Science.
THE ROLE OF CHEMICAL BONDING IN ADHESION Annual Technical Report
A. N. Gent, P. Dreyfuss, and M. L. Runge 21 Nov. 1977 27 p refs
(Contract N00014-76-C-0408)
(AD-A047091; TR-2) Avail: NTIS HC A03/MF A01 CSCL 07/4

Strong positive effects have been found when a polybutadiene layer is adhered to a glass substrate by means of interfacial chemical bonds. The bond fracture energy increased by a factor of over 20 when a reactive polysiloxane coating was applied to the glass in comparison with a similar, but nonreactive, polysiloxane coating and the chemically-bonded layer failed cohesively instead of interfacially. Swelling stresses were found to discriminate between strongly bonded systems of this type. After a swelling period in pentane ranging from 10 minutes to over 72 hours, depending upon the proportion of chemical bonding introduced, the layer detached spontaneously. This suggests a possible test method for distinguishing between bonded systems which would normally all fail by cohesive rupture. Treatment of glass substrates with a monofunctional polybutadiene containing a dimethylmethoxysilane endgroup led to no significant improvement in adhesion. SEM Studies showed that less than 5 percent of the surface was covered by the monofunctional material. Thus it appears that the number of reactive sites per molecule is an important factor governing elastomer adhesion. An unexpectedly-high level of adhesion was observed between simple hydrocarbon elastomers and certain polymeric substrates: 2,6-dimethyl-1,4-polyphenylene oxide, polysulfone, and polycarbonate. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

N78-16194*# United Technologies Research Center, East Hartford, Conn.
DEVELOPMENT OF AN EXPERIMENT FOR DETERMINING THE AUTOIGNITION CHARACTERISTICS OF AIRCRAFT-TYPE FUELS
Louis J. Spadaccini Sep. 1977 30 p refs
(Contract NAS3-20066)
(NASA-CR-135329; R78-912881-2) Avail: NTIS HC A03/MF A01 CSCL 21D

An experimental test apparatus was developed to determine the autoignition characteristics of aircraft-type fuels in premixing prevaporizing passages at elevated temperatures and pressures. The experiment was designed to permit independent variation and evaluation of the experimental variables of pressure, temperature, flow rate, and fuel-air ratio. A comprehensive review of the autoignition literature is presented. Performance verification tests consisting of measurements of the ignition delay times for several lean fuel-air mixture ratios were conducted using Jet-A fuel at inlet air temperatures in the range 600 K to 900 K and pressures in the range 9 atm to 30 atm. Author

N78-16195# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
DETERMINATION OF THE EFFECT OF PRETEST RATINGS OF JET FUEL THERMAL OXIDATION TESTER TUBES ON POST-TEST RATINGS USING THE TUBE DEPOSIT RATER Final Report, Jun. 1975 - Jun. 1977
Jun. 1977 50 p refs
(AD-A047276; AFAPL-TR-77-53) Avail: NTIS HC A03/MF A01 CSCL 11/4

The Jet Fuel Thermal Oxidation Tester (JFTOT) is used by the Air Force to determine the thermal stability of JP-4 and JPTS type fuels. A device called the Tube Deposit Rater (TDR) has been proposed as a means of evaluating the deposits formed on JFTOT tubes. Concern has existed about the need to account for the pretest condition of the test tubes. The effect of pretest ratings is discussed in the report and a method is proposed for improving results by accounting for the pretest condition of the tubes. Author (GRA)

N78-16196# Hercules, Inc., Magna, Utah. Bacchus Works.
MANUFACTURE OF PCDE PREPOLYMER Final Report, Jan. 1973 - May 1977
S. M. Nielson Oct. 1977 278 p refs
(Contracts F04611-73-C-0051; F04611-75-C-0024)
(AD-A047154; AFRPL-TR-77-45) Avail: NTIS HC A13/MF A01 CSCL 21/9

Under Air Force Contract F33615-68-C-1568, Shell Development Company developed and evaluated a process for making PCDE, progressing through the intermediate steps of PECH, DEPECH, and PBEP. Hercules Incorporated, under Shell Contract SDNO 84723, for Air Force Contract F33615-72-C-1446, successfully demonstrated the PBEP and PCDE processes at rates of 6 lb/hr and provided other data pertinent to designing a large scale PCDE manufacturing plant. Study was made of two methods for increasing the molecular weight and functionality of PCDE by improving the qualities in the PECH. The first method was to subject 'standard' PECH to treatment that would retain only the higher molecular weight fraction. The second method used was to vary the PECH process to increase the molecular weight and functionality. The latter approach, a low temperature process, was chosen as the best method for making improved product. GRA

N78-16197# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
DEFINITION OF AVIATION TURBINE FUEL CONTAMINATION UNDER SIMULATED COMBAT CONDITIONS Final Report, Mar. 1976 - Sep. 1977
J. A. Russell, J. D. Tosh, F. M. Newman, M. K. Greenberg, and J. H. Frazar Sep. 1977 148 p
(Contract DAAG53-76-C-0003)
(AD-A047223; AFLRL-90) Avail: NTIS HC A07/MF A01 CSCL 21/4

JP-4 drain samples were obtained from Army aircraft, tank trucks, and other points in the fuel supply system at six field exercises under intensive training conditions. The samples were analyzed for particulate contaminants and compared to the contaminants package for test fluids used in aviation gas turbine engine component and systems qualification testing under

AV-E-8593B. Results indicate that (1) the vast majority of samples had contamination concentration levels several orders of magnitude less than the AV-E-8593B package, (2) an unexpectedly high number of aircraft drain samples (roughly 7 percent) and numerous points in the refueling systems showed concentrations far exceeding this package. Both the quantities and chemical nature of these particulate contaminants indicate that the AV-E-8593B package is realistic and representative of contamination which can occasionally occur in field Army operations. The utilization of this contaminants package therefore provides suitably stringent criteria for bench test qualification of aviation gas turbine engine fuel system components.
Author (GRA)

N78-16198# Federal Energy Administration, Washington, D. C. Strategic Petroleum Reserve Office.
STRATEGIC PETROLEUM RESERVE Final Environmental Impact Statement
Sep. 1977 266 p refs Supplement
(PB-273487/9; FEA/S-77/329; FEA-76/2-Draft-Suppl) Avail: NTIS HC A12/MF A01 CSCL 21D

The Strategic Petroleum Reserve mitigates the economic impacts of any future interruptions of petroleum imports. The impacts of storing one hundred fifty million barrels(MMB) of oil by 1978 and five hundred MMB by 1982 was addressed in the final programmatic EIS and the SPR plan. It is now proposed that the SPR be expanded to store a total of 1,000 MMB. The environmental impacts of proposed expansion was addressed.
GRA

N78-16199# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
STUDIES OF HYDROGEN LIQUEFIER EFFICIENCY AND THE RECOVERY OF THE LIQUEFACTION ENERGY
R. O. Voth and W. R. Parrish Aug. 1977 63 p refs
(PB-274058/7; NBSIR-77-862) Avail: NTIS HC A04/MF A01 CSCL 21D

The economics of liquefying hydrogen are costly both in the energy required to produce the liquid and in the capital costs of the liquefier. These costs could be reduced by increasing the liquefier efficiency and/or by recovering a portion of the liquefaction energy at the use site. The maximum hydrogen liquefier efficiency is provided based on the efficiency of available components and the fraction of original liquefaction energy that can be recovered at the use site. Since the inefficient compressors and expanders are the major cause of liquefier inefficiency, no increase in liquefier efficiency above the current 30 to 35 percent is probable without a corresponding increase in compressor and expander efficiency -- a difficult task since both the compressors and expanders have a long and stable history of development. However, roughly one-third to one-half of the actual energy required to liquefy hydrogen can be recovered at the use site and this represents a cost credit for liquid hydrogen. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N78-16200 Toledo Univ., Ohio.
THE THERMAL CONDUCTIVITY OF SOLID HYDROGEN WITH ORTHO HYDROGEN CONCENTRATIONS BETWEEN 20% AND 75% Ph.D. Thesis
James Emerson Huebler 1977 125 p
Avail: Univ. Microfilms Order No. 77-23668

The thermal conductivity of solid hydrogen in the temperature range of 1.4 to 13 K was measured. Measurements were taken on a single sample over a 196 hour period. During this time the ortho hydrogen concentration changed from 75% to 19.8%. Because precise temperature control allowed corrections to be made for changing ortho concentration, thermal conductivity versus temperature is given for constant ortho hydrogen concentrations of 20%, 30%, 40%, 50%, 60%, and 70%. Addition of thermal resistances was assumed and several curve fits to the data are given, including one with terms proportional to c2T-2 and cT-3 Dissert. Abstr.

N78-16201 Minnesota Univ., Minneapolis.
MEASUREMENTS OF THE OSMOTIC PRESSURE IN LIQUID MIXTURES OF HE-3 AND HE-4 NEAR THE LAMBDA LINE AND TRICRITICAL POINT Ph.D. Thesis
Clayton Alan Gearhart, Jr. 1977 214 p
Avail: Univ. Microfilms Order No. 77-26097

Values of the concentration susceptibility near the lambda line and tricritical point in liquid mixtures of He-3 and He-4 were calculated from measurements of osmotic pressure differences. Measurements were made by inducing a small He-3 mole fraction difference between two chambers separated by a pressure transducer, and measuring the resulting osmotic pressure difference as a function of temperature. Osmotic equilibrium was established through a Vycor glass superleak, which for He mole fraction $x > 0.55$ functions not only in the super-fluid phase but in portions of the normal fluid region of the phase diagram as well. Measurements were made at four He mole fractions, $x = 0.59$, $x = 0.64$, $x = 0.68$, and $x = 0.70$. Dissert. Abstr.

N78-16202 Oregon Univ., Eugene.
TURBULENCE IN HELIUM II COUNTERFLOW IN WIDE CHANNELS Ph.D. Thesis
Michael William Cromar 1977 84 p
Avail: Univ. Microfilms Order No. 77-27191

Some properties of the density of vortex lines produced by Helium 2 thermal counterflow in wide channels (approximately 1.0 cm) are studied. The homogeneity of the steady state vortex line density is determined from local measurements of second sound attenuation at nine positions along a 40 cm channel. The vortex line density has a moderately steep gradient near the heater and is fairly uniform over the remainder of the channel. The second sound attenuation produced by thermal counterflow is compared with that produced by rotation of the cryostat. This allows determination of the absolute vortex line density produced by the counterflow. This measurement agrees well with existing work. Fluctuations in the vortex line density are studied by observing the attenuation of second waves and ion currents. The root mean square amplitude of the fluctuations is approximately three percent of the total attenuation. Dissert. Abstr.

N78-16203 Wisconsin Univ., Madison.
THE EFFECT OF FLEXIBLE APPENDAGES ON SHAFT WHIRL STABILITY Ph.D. Thesis
Francis Joseph Wilgen 1977 122 p
Avail: Univ. Microfilms Order No. 77-19132

A theory was developed, based on the method of Liapunov, sufficiently general to obtain stability criteria for shaft-appendage systems comprising any number of flexible continuous appendages. Two models consisting of a flexible continuous disk appendage and a flexible continuous beam appendage located at an arbitrary position on a flexible continuous shaft were examined in detail. Stability boundaries are presented as functions of the appendage flexibility parameter. Dissert. Abstr.

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N78-16204 California Univ., Los Angeles.
ADVANCES IN DIGITAL SIGNAL PROCESSING WITH APPLICATIONS TO AIRBORNE PULSE DOPPLER RADAR Ph.D. Thesis
Daniel Dagfin Rivers 1977 147 p
Avail: Univ. Microfilms Order No. 77-23918

New results were obtained in several areas of digital signal processing. A formula was derived for interpolation in the frequency domain when successive FFT output vectors (spectra) are available. A technique was devised to compensate digitally for gain and phase imbalances arising in analog circuitry following an IQ detector. Data turning, a new concept which allows great flexibility in the digital computation of signal spectra, is defined and analyzed as to its impact on system signal-to-noise ratio

and signal processor loading. A complete design procedure for variable width clutter attenuation filters is outlined. Problems such as filter state buildups and noise performance are discussed. The problem of optimal design of elliptic filters is addressed. Numerical results are included as appropriate to demonstrate the efficacy of the various new techniques. Dissert. Abstr.

N78-16205 British Broadcasting Corp., Kingswood (England). Engineering Div.
A DIGITAL SPLIT-BAND COMPANDOR FOR 64 kbit/s CODING OF SPEECH WITH A 7 kHz BANDWIDTH
W. I. Manson and D. W. Stebbings Nov. 1977 8 p refs
(BBC-RD-1977/41) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

A bit saving technique for enabling good quality 7 kHz bandwidth speech signals to be coded for transmission in a 64 kbit/s channel for public broadcasting is described. The performance of an experimental compandor dividing the program spectrum into three bands is evaluated. A.R.H.

N78-16206 British Broadcasting Corp., Kingswood (England). Engineering Div.
LF AND MF SKY-WAVE PROPAGATION: THE ORIGIN OF THE CAIRO CURVES
P. Knight Nov. 1977 10 p refs
(BBC-RD-1977/42) Copyright. Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Measurements made at low and medium frequency on paths of up to 12,000 km were used to derive the Cairo radiowave propagation curves. The origin of the curves and the measurements from which they were derived are described. Both curves appear to be 10 dB higher than the measurements indicate, at the greatest distance for which they are drawn. The North-South curve may have been influenced by sea gain and the East-West curve by solar activity. Author

N78-16207 British Broadcasting Corp., Kingswood (England). Engineering Div.
TRAFFIC INFORMATION SERVICE: TRIALS AND DEVELOPMENTS 1975/76
M. W. Harman Nov. 1977 19 p refs
(BBC-RD-1977/44) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The need and feasibility of introducing a dedicated traffic information service, using a single medium frequency in time division multiplex, to serve the United Kingdom was established. A study of the effectiveness of a muting system in the receiver relying entirely on signal strength for restricting the coverage of each transmitter to local areas, revealed that variations of signal with vehicle movement gave spasmodic mute operation. This deficiency may be particularly prevalent in fringe areas, causing only parts of messages to be heard, leading to possible confusion and ambiguity when interpreting the information. A field trial was set up to pursue the development of a system that would overcome the problem of message fragmentation when motoring in an urban environment or leaving a service area. A description was given of the various listening modes offered by a prototype receiver, designed to respond to tone codes in transmissions. An analysis of results, based on the probability of communicating with a moving vehicle shows that the problem of message interruption due to local field-strength variations was overcome. Author

N78-16208 British Broadcasting Corp., Kingswood (England). Engineering Div.
THE RELATIONSHIP OF VHF CAR RADIO RECEPTION QUALITY TO FIELD STRENGTH AT 10 METRES
D. Vinnell Dec. 1977 15 p refs
(BBC-RD-1977/45) Avail: NTIS Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The results of practical tests of reception in cars were used to estimate the field-strength at 10m above ground required for a satisfactory service. They showed considerable receiver to receiver variations, with more recent receivers incorporating active interference limiting circuits showing a marked advantage. The suggested limit for a satisfactory service is 60 db micrometers V/m) assuming horizontally polarized transmission. Tests on transmissions with mixed polarization indicated a smaller advantage. Author

N78-16209 Alabama Univ., Huntsville.
SCATTERING OF ELECTROMAGNETIC WAVES FROM A ROUGH DIELECTRIC SURFACE Ph.D. Thesis
James Andrew Holzer 1977 132 p
Avail: Univ. Microfilms Order No. 77-25054

The vector Kirchhoff off integral was used to calculate the mean intensity reflected from a randomly rough, statistically homogeneous, dielectric with a Gaussian distribution of surface heights whose rms value was large compared to a wavelength. The electric and the magnetic fields on the boundary were related to the incident fields through the Fresnel reflection coefficients applied to a plane tangent to each portion of the surface which must be microscopically smooth for several wavelengths. The ensemble averages over the random surface variables were performed exactly using a new technique (the spectral representation of the scattering function which makes the questionable approximations in the previous solutions to the problem unnecessary). The special case of a corrugated surface was treated numerically to gain insight into the more general problem. Dissert. Abstr.

N78-16210 California Inst. of Tech., Pasadena.
WAVE PROPAGATION IN SATURATED POROUS MEDIA Ph.D. Thesis
Hans VanDerKogel 1977 263 p
Avail: Univ. Microfilms Order No. 77-24050

A theoretical model having a fluid and a solid phase, both modeled as a continuum was developed for investigation wave propagation in saturated porous media. The solid phase consists of incompressible grains forming a compressible skeleton; the fluid phase represents a compressible fluid located between the grains. Equations of state are formulated and nonlinear balance laws are linearized. The solution to the problem of reflection and refraction of a discontinuity propagating in a fluid and impinging on a two-phase medium is presented. The theory is extended in multi-dimensions, in order to allow shear waves to propagate. The existence of nonpropagating discontinuities in dilatant shear is demonstrated. A photoelastic technique and a high speed camera were used to record interparticle stresses behind the wavefront on dry and saturated discs to observe phase velocity differences and the separation of particles. Dissert. Abstr.

N78-16211 Case Western Reserve Univ., Cleveland, Ohio.
TRANSMISSION RATE LIMITATIONS FOR FINITE DURATION SIGNALS IN A BINARY COMMUNICATION SYSTEM Ph.D. Thesis
Philipp Dines 1977 146 p
Avail: Univ. Microfilms Order No. 77-25152

Finite duration signals were derived which have, while under an amplitude constraint, the optimally reported energy transmission efficiencies. A comparison, with the same communication system, was made between the performance characteristics of these newly developed signals, demonstrating their improvements, and those obtained by previous investigators for signals of strictly finite duration, exclusively. The finite duration signals derived and their corresponding time limited outputs from the channel were illustrated with computer drawn graphs. The numerical system simulation performed, employing the FFT algorithm, is also described. A general circuit design for a pulse generator of the optimized finite duration signals developed is presented along with the description of an example hardware realization which was accomplished for the pulse generator. Dissert. Abstr.

N78-16212 George Washington Univ., Washington, D. C.
SCATTERING IN DISCRETE RANDOM MEDIA WITH IMPLICATIONS TO PROPAGATION THROUGH RAIN Ph.D. Thesis
Louis Joseph Ippolito, Jr. 1977 145 p
Avail: Univ. Microfilms Order No. 77-20699

An investigation of the multiple scattering effects on wave propagation through a volume of discrete scatterers was accomplished. The mean field and intensity for a distribution of scatterers was developed using a discrete random media formulation, and second order series expansions for the mean

field and total intensity derived for one dimensional and three dimensional configurations. The volume distribution results were shown to proceed directly from the one dimensional results.
Dissert. Abstr.

N78-16213 Arkansas Univ., Fayetteville.
DIGITAL COMMUNICATION SYSTEM PERFORMANCE USING BOTH TEMPORAL AND SPATIAL MODULATION Ph.D. Thesis
Harold Baxter Killen 1977 99 p
Avail: Univ. Microfilms Order No. 77-23368

The transmission of digital information by electromagnetic wave propagation using simultaneous temporal and spatial modulation was considered from both a theoretical and a practical viewpoint. This work was extended to include the transmission of modified Hermite polynomials as the spatial function. In particular, this work presented a technique by which a set of spatial functions, which were the natural resonant modes of a confocal optical resonator that did not transform into an orthogonal set at the receiving aperture, could be used for transmission of digital information. The concept of super resolution, resolution beyond the diffraction limit, was used to show that the transmission of prolate spheroidal waveforms as the spatial function was a special case of the more arbitrary set of functions. System performance was compared using the two sets of spatial functions. Dissert. Abstr.

N78-16214 Johns Hopkins Univ., Baltimore, Md.
ALTERNATIVE TELECOMMUNICATION MODES FOR CONFLICTIVE AND COOPERATIVE PROBLEM SOLVING Ph.D. Thesis
Gerald D. Weeks 1974 140 p
Avail: Univ. Microfilms Order No. 77-16566

Channels simulating various modes of telecommunication were: teletypewriter, telephone, closed-circuit television, and as a control, face-to-face conversation. The problem-solving tasks were of two distinct kinds (conflictive and cooperative) structured to elicit a different form of interactive communication. Performance was assessed on three classes of dependent measures: time to solution, behavioral measures of activity, and measures of verbal productivity. Solutions to all problems in the voice modes were much faster but far more verbose than those in the teletypewriter mode. The presence of a visual channel during the conflective problem-solving sessions had a strong effect on how subjects allocated their time. Dissert. Abstr.

N78-16215# Saab-Scania, Linkoping (Sweden). Aerospace Div.
SOME CHARACTERISTICS OF FREQUENCY MEASURING FMCW-RADAR ALTIMETERS OPERATING ABOVE A ROUGH GROUND SURFACE
Sune Axelsson 1977 109 p refs
(SAAB-Repr-Ae-4; TR-157) Avail: NTIS HC A06/MF A01

A model for the altimetry signal received from a rough scattering ground surface is postulated and analyzed in the case of a frequency counting FMCW radar altimeter. The general relationships between the altitude bias, noise level and the properties of the rough surface are investigated as well as the influence of smoothing time, signal bandwidth, Doppler bandwidth, and modulation frequency. The coupling between the noise level and the smoothing time is studied for a Gaussian scattering function and saw-tooth modulation. Even smoothing times longer than one modulation cycle are considered. A minimum noise level is obtained for high values of signal bandwidth and modulation frequency. A significant deviation between the noise levels of a zero crossings counter and phase differentiating detector is obtained only for surface roughnesses much smaller than the wavelength corresponding to the frequency excursion. Author

N78-16216*# Texas Instruments, Inc., Dallas. Equipment Group.
RADAR IMAGE PROCESSING MODULE DEVELOPMENT PROGRAM, PHASE 3 Final Report
Aug. 1977 86 p refs Prepared for JPL
(Contracts JPL-954340; JPL-953954; JPL-954087)
(NASA-CR-155579) Avail: NTIS HC A05/MF A01 CSCL 17I

The feasibility of using charge coupled devices in an IPM for processing synthetic aperture radar signals onboard the NASA Convair 990 (CV990) aircraft was demonstrated. Radar data onboard the aircraft was recorded and processed using a CCD sampler and digital tape recorder. A description of equipment and testing was provided. The derivation of the digital presum filter was documented. Photographs of the sampler/tape recorder, real time display and circuit boards in the IPM were also included. Author

N78-16217*# OAO Corp., Beltsville, Md.
US SEARCH AND RESCUE MISSION CONTROL CENTER FUNCTIONS Final Report
15 Dec. 1977 38 p refs
(Contract NASw-3058)
(NASA-CR-155572) Avail: NTIS HC A03/MF A01 CSCL 17B

A satellite aided Search and Rescue (SAR) Mission concept consisting of a local coverage bent pipe system, and a global coverage system is described. The SAR instrument is to consist of a Canadian repeater and a French processor for which Canada and France, respectively are to evaluate health and trends. Performance evaluations of each system were provided. The United States and Canada will each have a Search and Rescue Mission Control Center (MCC) and their functions were also examined. A summary of the interface requirements necessary to perform each function was included as well as the information requirements between the USMCC and each of its interfaces. Physical requirements such as location, manning etc. of the USMCC were discussed. Author

N78-16218*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STATE CRIMINAL JUSTICE TELECOMMUNICATIONS (STACOM). VOLUME 1: EXECUTIVE SUMMARY Final Report
J. E. Fielding, H. K. Frewing, Jun-Ji Lee, W. G. Leflang, and N. B. Reilly 31 Oct. 1977 52 p refs Sponsored in part by Dept. of Justice 4 Vol.
(Contract NAS7-100)
(NASA-CR-155558; JPL-Pub-77-53-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 17B

Techniques for identifying user requirements and network designs for criminal justice networks on a state wide basis are discussed. Topics covered include: methods for determining data required; data collection and survey; data organization procedures, and methods for forecasting network traffic volumes. Developed network design techniques center around a computerized topology program which enables the user to generate least cost network topologies that satisfy network traffic requirements, response time requirements and other specified functional requirements. The developed techniques were applied in Texas and Ohio, and results of these studies are presented. Author

N78-16219*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STATE CRIMINAL JUSTICE TELECOMMUNICATIONS (STACOM). VOLUME 2: REQUIREMENTS ANALYSIS AND DESIGN OF OHIO CRIMINAL JUSTICE TELECOMMUNICATIONS NETWORK Final Report
J. E. Fielding, H. K. Frewing, Jun-Ji Lee, and N. B. Reilly 31 Oct. 1977 318 p refs Sponsored in part by Dept. of Justice 4 Vol.
(Contract NAS7-100)
(NASA-CR-155557; JPL-Pub-77-53-Vol-2) Avail: NTIS HC A14/MF A01 CSCL 17B
For abstract, see N78-16218.

N78-16220*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STATE CRIMINAL JUSTICE TELECOMMUNICATIONS (STACOM). VOLUME 3: REQUIREMENTS ANALYSIS AND DESIGN OF TEXAS CRIMINAL JUSTICE TELECOMMUNICATIONS NETWORK Final Report
J. E. Fielding, H. K. Frewing, Jun-Ji Lee, and N. B. Reilly 31 Oct. 1977 324 p refs Sponsored in part by Dept. of Justice 4 Vol.
(Contract NAS7-100)
(NASA-CR-155556; JPL-Pub-77-53-Vol-3) Avail: NTIS HC A14/MF A01 CSCL 17B
For abstract, see N78-16218.

N78-16221*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STATE CRIMINAL JUSTICE TELECOMMUNICATIONS (STACOM). VOLUME 4: NETWORK DESIGN SOFTWARE USER'S GUIDE Final Report
Jun-ji Lee 31 Oct. 1977 148 p refs Sponsored in part by Dept. of Justice 4 Vol.
(Contract NAS7-100)
(NASA-CR-155555; JPL-Pub-77-53-Vol-4) Avail: NTIS HC A07/MF A01 CSCL 17B

A user's guide to the network design program is presented. The program is written in FORTRAN V and implemented on a UNIVAC 1108 computer under the EXEC-8 operating system which enables the user to construct least-cost network topologies for criminal justice digital telecommunications networks. A complete description of program features, inputs, processing logic, and outputs is presented, and a sample run and a program listing are included. Author

N78-16222# University Coll. of Wales, Aberystwyth. Dept. of Physics.
ATS-6 OBSERVATIONS OF IONOSPHERIC/ PROTONOSPHERIC ELECTRON CONTENT AND FLUX Final Scientific Report, 1 Jul. 1975 - 31 Dec. 1976
L. Kersley, H. Kajeb-Hosseinieh, and K. J. Edwards 28 Feb. 1977 122 p refs
(Grant AF-AFOSR-2267-72; AF Proj. 4643)
(AD-A046762; AFGL-TR-77-0107) Avail: NTIS MF A01 CSCL 20/14

The ATS-6 radio beacon experiment carried out at Aberystwyth (52.42 N, 4.05 W) is described. A preliminary analysis of the data is described concentrating on hourly values of total electron content (N sub T), Faraday content (N sub F), protonospheric content (N sub P) and layer shape F-factor. The monthly media behavior of the parameters is discussed together with the effects of observational and analysis error on the accuracy of the protonospheric content values. The correction for layer height changes has been found to be of much less importance for European stations observing during Phase II ATS-6 operations than for measurements made in America during Phase I. The dynamic interchange of plasma between ionosphere and protonosphere has been studied by estimating hourly values of average integrated net fluxes from the temporal gradient of protonospheric content. The protonospheric flux data have been interpreted qualitatively in terms of diffusive interaction between ionosphere and protonosphere in both local and conjugate hemispheres. Added confirmation is obtained by consideration of contrasting protonospheric data from an American sector station which can also be related to ionospheric behavior in the two hemispheres. GRA

N78-16223# National Commission on Electronic Fund Transfers, Washington, D. C.
THE EFFECT OF EXISTING LAW AND REGULATION ON THE OFFERING OF TELECOMMUNICATIONS SERVICES
Jun. 1977 19 p refs
(PB-272570/3; NCEFT-IWD-45) Avail: NTIS HC A02/MF A01 CSCL 17B

The statutory and regulatory environment for the offering of telecommunication services is described. Regulation by the Federal Communication Commission, pursuant to the Communications Act of 1934, as amended, 47 U.S.C.S151, et seq. (197), of entry to construct new transmission facilities or offer new services on an interstate communications common carrier basis, the development and sale of EFT terminals, and the pricing of common carrier services are discussed. GRA

N78-16224# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
ARPANET ROUTING STUDY Final Report
John M. McQuillan, Ira Richer, and Eric Rosen 5 Sep. 1977 173 p
(Contract DCA200-77-C-0616)
(AD-A047043; BBN-3641; SBIE-AD-E100003) Avail: NTIS HC A08/MF A01 CSCL 09/2

For several years ARPANET has been subjected to occasional disturbances (referred to as network glitches or network disturbances). Frequency of these disturbances increased from once every 2 or 3 days to 3 or 4 a day in April 1977. This increase was traced to a change in the IMP software governing the satellite line between SDAC and NORSAR reducing the number of packets per flight. When the software was changed back to allow 16 packets per flight the number of disturbances decreased dramatically. However network disturbances are not the result of this one isolated bug. Other causes include: faulty IMP hardware, software bugs, circuit difficulties, traffic overloads, etc. The real problem is not any particular irritant but the vulnerability of the ARPANET to congestion caused by such irritants. Author (GRA)

N78-16225# Hughes Research Labs., Malibu, Calif.
LOW POWER HIGH DATA RATE MODULATOR Final Report, 2 Jan. - 30 Sep. 1976
G. L. Tangonan Jun. 1977 38 p refs
(Contract F33615-75-C-1028)
(AD-A046952; AFAL-TR-77-36) Avail: NTIS HC A03/MF A01 CSCL 17/2

The objective of this program was to develop a high-data-rate-low-power modulator for doubled Nd:YAG applications with Gigabit/sec data rate capability, 3 W drive power and capable of handling 0.5 W CW power (3.3 W peak) using integrated optics techniques. An approach to the development of this modulator has been defined. Most notable is the demonstration of optical power handling capabilities of Ti diffused LiTaO3 waveguides of >300 mW with no damage and no power saturation. Prism coupling efficiency of 55% input and 80% output have been achieved. The waveguide losses at 5145 A have been measured to be 5 db/cm. Single mode and multi-mode waveguides have been found by the in-diffusion process. The nature of the optical waveguide damage at room temperature and at elevated temperatures (approx 150 C) has been studied. The high optical power densities sustained by these structures were accommodated by high temperature operation of the waveguide structures. Preliminary experiments on Bragg deflection have also been carried out. Author (GRA)

N78-16226# Naval Surface Weapons Center, Dahlgren, Va.
COMPUTATION OF VELOCITY IN THE WAVE TRAIN OF A POINT SOURCE Final Report
A. V. Hershey Sep. 1977 50 p refs
(AD-A047291; NSWC/DL-TR-3720) Avail: NTIS HC A03/MF A01 CSCL 20/4

The velocity potential and the components of velocity in the wave train of a point source are derived from Havelock's integral. Analysis and documentation are given for the computation of velocity by trapezoidal integration, by asymptotic approximation, and by integration by parts. Accuracy and efficiency are least dependent upon the depth of the source in the integration by parts. The three methods of computation are available for application in a set of subroutines. Author (GRA)

N78-16227# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
TERMINAL INTERFACE MESSAGE PROCESSOR. USER'S GUIDE TO THE TERMINAL IMP
J. Malman Jul. 1977 69 p Revised
(Contract DCA200-77-C-0616)
(AD-A047041; BBN-2183-Rev-77) Avail: NTIS HC A04/MF A01 CSCL 17/2

This report describes the use of a terminal connected to a Terminal IMP (TIP) in the ARPA Network. The report assumes that the user knows how to operate a server Host system somewhere on the network once he becomes connected to that system, and the report defines the procedures and options the user has available to establish that connection. The ARPA Network, IMPs and TIPs, hardware maintenance, TIP operation, and formats and protocols are not described here. The bibliography (Appendix C) lists the relevant documents. Where possible, all types of these devices have been operated with direct connections to the TIP and also over a 103A dial-up modem. We have also briefly operated the iTP or heard of the TIP being operated with a variety of other types of terminals. These are listed in Appendix D. For your own safety, before you purchase any terminal listed in Appendix D or any other terminal for use with the TIP, you should check with BBN and try it with a TIP. One TIP is configured with a magnetic tape drive which is used as discussed in Section 8. It should be noted that the TIP is designed to support interactive, asynchronous terminals. It cannot normally support synchronous devices, or devices whose input (to the

TIP) characteristics are significantly different from a human typist. GRA

N78-16228# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MEASUREMENTS OF VOICE AND DATA QUEUE BEHAVIOR IN A PVC NETWORK LINK
Paul Demko 25 Aug. 1977 28 p refs
(Contract F19628-76-C-0002)
(AD-A047101; TN-1977-37; ESD-TR-77-228) Avail: NTIS HC A03/MF A01 CSCL 17/2

This note describes measurements made on a computer simulation of a model of a Packetized Virtual Circuit (PVC) network link. The simulation models on a population of speakers in conversation, and a Poisson data source. Such variables as buffer space requirements, packet loss and delay, and link utilization are investigated as functions of voice and data loads on the system. Initial results indicate that voice and data can be satisfactorily integrated on a 1.544 Mbps packetized communications link with total link utilizations greater than 90%.
Author (GRA)

N78-16229# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A TIME DIVERSITY CODING EXPERIMENT FOR A UHF/VHF SATELLITE CHANNEL WITH SCINTILLATION: EQUIPMENT DESCRIPTION
David P. White 1 Sep. 1977 105 p refs
(Contract F19628-76-C-0002)
(AD-A047102; TN-1977-22; ESD-TR-77-217) Avail: NTIS HC A06/MF A01 CSCL 17/2

Satellite communications in the UHF and VHF bands has at various times and in certain receiver locations on the earth's surface been subject to moderate to severe degradation as a result of scintillation. The affected receiver areas are confined primarily to the equatorial regions and to a lesser extent over the sub-auroral to polar cap areas. For the equatorial region (more specifically, a band centered on the geomagnetic equator) the scintillation is largely a nighttime phenomenon beginning shortly after local sunrise and diminishing after midnight. In response to the potential problem on the Navy's UHF fleet broadcast channel we have conducted a study on the communication alternatives as well as an extensive field experiment. The field experiment was conducted between Hawaii and Guam over the Pacific Gapfiller (Marisat) satellite from August 1976 through January 1977. Author (GRA)

N78-16230# Magnavox-General Atronics, Philadelphia, Pa.
ADAPTIVE SAME FREQUENCY REPEATER (SFR) BREADBOARD IMPROVEMENTS Final Technical Report, 14 Jun. 1976 - 1 Apr. 1977
Burton S. Abrams, Michael Caracappa, and Andrew E. Zeger Oct. 1977 82 p refs
(Contract F30602-74-C-0242; ARPA Order 2750)
(AD-A047208; GAC-2896-2876-36; RADC-TR-77-347) Avail: NTIS HC A05/MF A01 CSCL 17/2

This report documents the technical effort conducted under Amendement P00003 to Contract F30602-74-C-0242. It presents the results of modifications to the real time, nonsampling, Same-Frequency Repeater breadboard equipment originally constructed under the above contract effort. The SFR is capable of relaying various types of analog and digital signals using coherent interference cancellation techniques to prevent oscillation. The main thrust of this effort was to increase the forward gain from the 67 db obtained in the initial effort to a performance goal of 100 - 120 db. The actual measured forward gain achieved in this follow-on effort was 102db. This improved forward gain was attained through modification of circuits in the breadboard equipment. The basic SFR system structure, and the concepts on which it was predicated remain intact. The results of the initial effort are summarized in RADC-Tr-76-78 entitled, 'Adaptive Same Frequency Repeater SFR) Study'. The modifications that were performed and the performance results obtained in this follow-on effort are discussed in this report. Updated system and circuit diagrams are included as well as a discussion of those technical areas where additional work would further improve SFR equipment performance. Author (GRA)

N78-16231# Rome Air Development Center, Griffiss AFB, N.Y.
TRENDS IN ARRAY ANTENNA RESEARCH
Robert J. Mailloux Jun. 1977 88 p refs
(AD-A047239; RADC-TR-77-195) Avail: NTIS HC A05/MF A01 CSCL 09/5

This paper describes a number of analytical developments in the history of phased array research and analyzes the present state of maturity of that field. The main conclusion of this study is that the technology is evolving so rapidly, and the number of different array types and requirements growing so swiftly, that past analytical developments are vastly inadequate to handle the problems posed by present day array systems. The paper highlights those areas where intensified research is necessary.
Author (GRA)

N78-16232# GTE Sylvania, Inc., Needham Heights, Mass. Electronic Systems Group.
AUTOMATED PERFORMANCE MONITORING AND ASSESSMENT FOR DCS DIGITAL SYSTEMS Phase Report, Nov. 1976 - Apr. 1977
Griffiss AFB, N. Y. RADC Oct. 1977 549 p
(Contract F30602-76-C-0433)
(AD-A047207; RADC-TR-77-327) Avail: NTIS HC A23/MF A01 CSCL 09/6

This study analyzes the DCS digital transmission system and requirements; defines the wideband digital (CPMAS) Communications Performance Monitoring and Assessment requirements; defines and evaluates CPMAS alternatives; recommends a wideband digital CPMAS approach; makes recommendations for the ATEC production; sets up a plan to demonstrate feasibility of wideband digital CPMAS approach (option phase), and makes recommendations for ATEC research and development programs. The Digital Transmission System Model provides multi-link routes, a variety of station types (e.g., nodal station, branching repeater station and terminal station) transmission equipments (e.g., Radio, Key Generator, Multiplexers, Submultiplexers and service channel multiplexers), and terminations (e.g., 4 kHz (PCM derived), async digital channels, digital groups, and 16 kb/s digital subchannels). The radios used for digital transmission include DRAMA-TI-4000 multiplexer baseband section (FKV). GRA

N78-16233# State Univ. of New York, Buffalo. Dept. of Electrical Engineering.
THE ALGORITHMIC GENERATION OF PSEUDO-OPTIMUM PULSE-BURST CODES Final Technical Report, 1 Jun. - 1 Aug. 1977
James A. Cadzow Sep. 1977 68 p refs
(Contract F30602-75-C-0122)
(AD-A047313; RADC-TR-77-312) Avail: NTIS HC A04/MF A01 CSCL 09/3

This report describes some initial results in the algorithmic generation of finite length pulse-burst signals whose autocorrelation functions are approximately impulse-like in nature. The codes will be restricted to be real with piecewise constant amplitude that can either be positive or negative (i.e., bi-phase). Such codes find various applications in radar signal processing and digital communication systems. A new pulse-burst code is presented and compared with the Barker and Hoffman codes.
Author (GRA)

N78-16234# Comsat Corp., Clarksburg, Md.
MULTIPLE BEAM TORUS ANTENNA STUDY, VOLUME 1 Final Report, Jul. 1976 - Feb. 1977
William J. English and Carol Rieger Mar. 1977 87 p refs 2 Vol.
(Contract DCA100-76-C-0050)
(AD-A047157; AD-E100000) Avail: NTIS HC A05/MF A01 CSCL 09/5

Offset-fed multiple beam torus antennas MBTA provide exceptional wide-angle sidelobe characteristics as a result of a blockage-free aperture. The formation of multiple beams at one or more frequency bands using shared apertures on a fixed reflector structure can result in significant cost savings in a DSCS system in which satellites are constrained to a fixed portion of the geo synchronous arc. Author (GRA)

N78-16235# Comsat Corp., Clarksburg, Md.
MULTIPLE BEAM TORUS ANTENNA STUDY, VOLUME 2 Final Report, Jul. 1976 - Feb. 1977

William J. English and Carol Rieger Mar. 1977 238 p refs 2 Vol.
(Contract DCA100-76-C-0050)
(AD-A047158; AD-E100001) Avail: NTIS HC A11/MF A01 CSCL 09/5

Partial contents: Geometrical and Beam Pointing Considerations Electrical RF Performance Characteristics Mechanical and Structural Characteristics of the Uncorrected Front. Fed MBTA and Cost Estimates for a Recoverable MBTA. GRA

N78-16236# Stanford Research Inst., Menlo Park, Calif.
INVESTIGATION OF THE USE OF FREQUENCY-DIVISION MULTIPLE ACCESS FOR APPLICATION WITH A MIX OF USER TERMINALS. VOLUME 1: SUMMARY AND RESULTS Final Report
Pravin C. Jain, V. Elaine Hatfield, John K. Leung, and D. Thomas Magill Dec. 1973 63 p refs 3 Vol.
(Contract DCA100-72-C-0033)
(AD-A047042) Avail: NTIS HC A04/MF A01 CSCL 17/2

This report presents the results of research performed to investigate the application of the frequency-division multiple-access (FDMA) technique for providing a mix of user terminals of differing characteristics--such as data rates, transmitter powers, and receiver sensitivities--with simultaneous access capability to a limiting satellite repeater. A computer program (SYSCON) has been developed to model a PSK/FDMA satellite communication system and to optimize its performance in operation with a mix of user terminals, through selection of power and frequency plans. This capability is achieved through optimization of a norm defined as the weighted sum of the link error rates and representing the figure of merit or a measure of the system's communications performance with respect to both the power and the frequency of the links. To obtain the expression for the error rate at the input of the FDMA links, it was necessary to derive general analytic expressions for the limiter output signal, the intermodulation, and the noise components, when n signals are transmitted simultaneously through the satellite repeater. The report consists of three volumes. Volume one provides a summary of the study which includes a description of the analysis approach, documentation of the pertinent equations, numerical results, and conclusions. GRA

N78-16237# Stanford Research Inst., Menlo Park, Calif.
INVESTIGATION OF THE USE OF FREQUENCY-DIVISION MULTIPLE ACCESS FOR APPLICATION WITH A MIX OF USER TERMINALS. VOLUME 2: APPENDICES Final Report
Pravin C. Jain, V. Elaine Hatfield, and John K. Leung Dec. 1973 108 p refs 3 Vol.
(Contract DCA100-72-C-0033)
(AD-A047044) Avail: NTIS HC A06/MF A01 CSCL 17/2

Volume two comprises three appendices giving detailed analyses of the problem areas in the investigation of the use of FDMA with a mix of user terminals of differing characteristics. Appendix A deals with the limiter transfer characteristic and provides a comprehensive theoretical investigation of the problem of transmitting a number of constant-envelope, phase-modulated FDMA carriers through a limiting satellite repeater. Appendix B analyzes the problem of detection of quadriphase-modulated FDMA carriers at the receiver after transmission through a limiting transponder. An expression for the bit-error probability at the output of an FDMA channel is obtained considering the presence of other FDMA carriers, cross products, and retransmitted up-link as well as down-link noise at the receiver input. Appendix C describes the computer program SYSCON. It also discusses the equations and subroutines used in system optimization. Author (GRA)

N78-16238# Stanford Research Inst., Menlo Park, Calif.
INVESTIGATION OF THE USE OF FREQUENCY-DIVISION MULTIPLE ACCESS FOR APPLICATION WITH A MIX OF USER TERMINALS. VOLUME 3: MULTIPLE-ACCESS TECHNIQUES Final Report
Pravin C. Jain, V. Elaine Hatfield, John K. Leung, and D. Thomas Magill Dec. 1973 183 p refs 3 Vol.
(Contract DCA100-72-C-0033)
(AD-A047045) Avail: NTIS HC A09/MF A01 CSCL 17/2

The three major multiple-access techniques are compared for a mix of user types--i.e., differing data rates and capacity quotients. The comparison is made with respect to eight performance criteria that are particularly important for the military environment. A general comparison indicates that frequency-division multiple access (FDMA) performs better than originally believed. A specific test case of 10 accesses with a variety of data rates and capacity quotients is selected for detailed evaluation. The quantitative comparison is based on satellite throughput. The performance of the FDMA system is optimized and evaluated using the computer program SYSCON developed under the other tasks of this study. FDMA is found to offer very nearly as much satellite throughput as the other two multiple-access techniques. Furthermore, FDMA offers the advantages of simplicity, low cost, and compatibility with existing equipment. Based on this example, it is concluded that FDMA can offer substantial advantages as compared to the other techniques. Further, more detailed studies are recommended to fully delineate the region of FDMA superiority. Author (GRA)

N78-16239# Rome Air Development Center, Griffiss AFB, N.Y.
THE DEVELOPMENT OF A COMPUTER SPEECH PROCESSING SYSTEM AND ITS USE FOR THE STUDY AND DEVELOPMENT OF PROCESSING METHODS FOR ENHANCING THE INTELLIGIBILITY OF SPEECH IN NOISE Interim Report, 6 Jun. - 26 Aug. 1977
Russell J. Niederjohn (Marquette Univ.) and Robert A. Curtis Oct. 1977 94 p refs
(AD-A047240; RADC-TR-77-310) Avail: NTIS MF A01 CSCL 17/2

This report describes results of an examination of four methods for processing speech so as to enhance its intelligibility in the presence of wideband random noise at the source. The four methods were: (1) INTEL, a method which involves processing in both the first and second order spectral domains; (2) Spectral subtraction, which involves a simple subtraction of the average noise spectrum from the first-order spectrum; (3) Minimum mean square error filtering, which involves filtering speech in such a way as to minimize the mean square error between a signal and its expected value in noise; and (4) Methods based upon suppressing the frequency content of a speech plus noise signal between pitch harmonics of the speech signal. To carry out a study of methods of enhance speech intelligibility in noise, two general-purpose computer processing systems were implemented. The first, a terminal interactive system for generation, analysis, and graphic display of synthetic voiced speech sounds, provided considerable insight into the effect of various processing algorithms upon speech and upon speech in noise. The second computer processing system has been developed for the processing of real speech. It involves use of a DDP-116 data converter and a Honeywell 6000 Computer. GRA

N78-16240# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
THE ADAPTIVE ROUTING PROBLEM FOR LARGE STORE-AND-FORWARD COMPUTER-COMMUNICATION NETWORKS Phase Report
C. E. Houstics and B. J. Leon Oct. 1977 80 p refs
(Contract F30602-75-C-0082; AF Proj. 9567)
(AD-A047206; RADC-TR-77-331) Avail: NTIS HC A05/MF A01 CSCL 17/2

This research investigates and evaluates routing procedures for large store-and-forward message switched computer communication networks. Existing network topologies are examined. An adaptive routing algorithm is developed dealing with message routing when the full length message is transmitted in its entirety. A thresholding technique is used to work with variations in message length. The algorithm's performance is evaluated by comparison with the performance of the exact mathematical deterministic routing problem. In order to apply the routing strategy to large networks, a partitioning approach is used. A partitioning algorithm is developed for communications network topologies. This algorithm uses a generalized labeling technique to find the appropriate partitions of the original network. The adaptive routing algorithm is modified in order to take into account large network considerations. Then it is applied to the partitioned network in a two-level hierarchical structure. The exact two-level modified adaptive routing algorithm is described. Some new network topologies found in the literature are examined

from the routing problem point of view. All the algorithms are tested by computer simulation. The adaptive routing algorithms have been implemented using two different simulation languages. Author (GRA)

N78-16241# Ohio State Univ., Columbus. ElectroScience Lab.
APPLICATION OF THE PLANE WAVE EXPANSION METHOD TO PERIODIC ARRAYS HAVING A SKEWED GRID GEOMETRY M.S. Thesis
T. Kornbau Wright-Patterson AFB, Ohio AFAL Oct. 1977 71 p refs
(Contract F33615-76-C-1024)
(AD-A047311; ESL-4346-3; AFAL-TR-77-112) Avail: NTIS HC A04/MF A01 CSCL 20/14

This report extends the Plane Wave Expansion Method of calculating the performance of periodic arrays to include arrays with a skewed grid structure. Previously, only rectangular grids could be calculated using this method. The Plane Wave Expansion Method is important since it may be used to calculate performance of arrays imbedded in dielectric and arrays with almost any element geometry. This work is important to the Air Force in that it enables us to compute metallic radome surfaces where the elements are located in a skewed fashion. This is a crucial step in designing metallic radomes of arbitrary shape. This added dimension to the Plane Wave Expansion Method has been used to investigate arrays of generalized three legged elements in a triangular grid structure. Author (GRA)

N78-16242# Naval Underwater Systems Center, New London, Conn. New London Lab.
SCATTERING OF PLANE WAVES FROM A COMPLAINT TUBE GRATING IN A LINEAR VISCOELASTIC LAYER
Ronald P. Radlinski 18 Aug. 1977 39 p refs
(AD-A047288; NUSC-TR-5433) Avail: NTIS HC A03/MF A01 CSCL 20/14

The nature of plane wave scattering from a grating in a viscoelastic medium is shown to be fundamentally different from that in a fluid or elastic medium. The solution to the generalized Helmholtz equation is determined in terms of inhomogeneous plane dilatational or shear (P or S) waves. Angles between the propagating and attenuating wave vectors are determined by the boundary conditions. The evanescent waves that arise from the grating equations cannot propagate parallel to the grating as is the case for an elastic-like or fluid medium. Measured transmission loss of plane waves incident on a compliant tube layer in a fluid are compared with predictions of an analytical model. The effects of the elastic stiffness and the mechanical loss factors of a layer of linear viscoelastic material on the performance of the compliant tube arrays are investigated for two different elastomeric encapsulants. Values of the complex shear modulus used as input to the model were determined by use of viscoelastic temperature-frequency relationships.
Author (GRA)

N78-16243# Naval Underwater Systems Center, New London, Conn. New London Lab.
OPERATING CHARACTERISTICS FOR DETECTION OF A FADING SIGNAL WITH K DEPENDENT FADES AND D-FOLD DIVERSITY IN M ALTERNATIVE LOCATIONS
Albert H. Nuttall 25 Oct. 1977 100 p refs
(AD-A047289; NUSC-TR-5739) Avail: NTIS HC A05/MF A01 CSCL 17/2

The probabilities of correct decision and false alarm for a fading signal with K dependent fades and D-fold diversity in M alternative locations are derived and numerically evaluated for a variety of values of K, M, and D, and for a wide range of signal-energy-to-noise-density ratio. It is found that the degradation in performance relative to that for K = 1 (NUSC Technical Report 4793) is given by approximately 3.5 log (K) db, in terms of required additional input signal-to-noise ratio to maintain the same error probabilities. The form of the optimum processor for K = 2 is derived; although it is not difficult to implement, it needs knowledge about the absolute levels of signal and noise and is very difficult to analyze in terms of error probabilities. For partially dependent signal fading and general K, the characteristic function of the decision variables is derived in closed form; however, no numerical evaluations are attempted for this generalization. Author (GRA)

N78-16244# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.
ANTENNA TILTING EXPERIMENTS OVER RADAR MICROWAVE LINKS Final Report
W. J. Hartman Feb. 1977 37 p refs
(Contract DOT-FA74WAI-419)
(AD-A038524; FAA-RD-77-51) Avail: NTIS HC A03/MF A01 CSCL 17/2

Signal level recordings were made simultaneously for two systems, one utilizing an antenna tilted upward to obtain a 2 db loss over optimum alignment and the other using an untilted antenna. The path was a 42.3 km FAA radar microwave link between Yemassee, South Carolina and Hardeeville, South Carolina over relatively flat terrain covered with tall trees. The results showed essentially identical fading on both systems.
Author (GRA)

N78-16245# Transportation Systems Center, Cambridge, Mass.
PRELIMINARY LIMITED SURVEILLANCE RADAR (LSR) COST/BENEFIT ANALYSIS Final Report, Dec. 1976 - Apr. 1977
Paul S. Rempfer Oct. 1977 53 p refs
(AD-A046829; TSC-FAA-77-16) Avail: NTIS HC A04/MF A01 CSCL 17/9

This report presents the findings of a cost/benefit analysis of the deployment of a new Limited Surveillance Radar (LSR). An LSR is an inexpensive, single channel, short-range (about 20 miles), primary radar for use at approach control facilities which cannot economically justify an Airport Surveillance Radar/Radar Beacon System (ASR/RBS). An LSR can also be used in tower cabs to aid in VFR operation where a BRITE display is not feasible due to coverage limitations dictated by obstructions or distance from the parent radar facility. The study is preliminary in that it is brief and uses rough estimates and assumptions for both benefits and costs. Its purpose is to give a gross estimate of the current deployment potential of the LSR and to aid in decisions regarding further system analysis, development, and testing. Author (GRA)

N78-16246# Ohio State Univ., Columbus. ElectroScience Lab.
OPTIMIZATION METHODS FOR ARRAYS OF NONPARALLEL WIRE ANTENNAS
John Sahalos Mar. 1977 41 p refs
(Contract N00014-76-C-0573)
(AD-A041529; ESL-4372-1) Avail: NTIS HC A03/MF A01 CSCL 09/5

Matrix methods are presented for optimization problems of arrays of straight, nonparallel, thin wire antennas. The general problem of optimizing certain performance indices with or without any number of constraints can be handled. The current distribution of any element of the array can be computed as a function of the voltages of the feed points of the array. First the moment method will be briefly given and then it will be shown how the matrices evaluated in the course of this method can be used in optimization problems. Author (GRA)

N78-16247# National Bureau of Standards, Washington, D. C. Law Enforcement Standards Lab.
IMAGE QUALITY OF MONOCHROME TELEVISION CAMERAS
Joseph C. Richmond Oct. 1977 18 p
(PB-273117/2; NBS-SP-480-25; NEAA-LESP-RPT-0311.00)
Avail: NTIS HC A02/MF A01 CSCL 17B

The operating characteristics most frequently quoted by manufacturers of monochrome television cameras are evaluated under limiting conditions of the scene parameters, and hence, define in a general way, the range of scene parameters over which the camera will produce useful pictures, but they do not give much information about the quality of the image produced. The contrast transfer function and the responsivity curve of the camera more information about image quality. A fourth camera operating characteristic, relative spectral response, which is independent of the other camera characteristics and scene parameters, may also affect image quality. GRA

N78-16248# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON TELECOMMUNICATIONS POLICY, RESEARCH AND DEVELOPMENT, NO. 26
6 Jan. 1978 74 p refs Transl. into ENGLISH from articles from Indonesia, Lebanon, USSR, Italy, Norway, and Portugal (JPRS-70432) Avail: NTIS HC A04/MF A01

Translations are presented from the world press and radio relating to worldwide political, economic and technical developments in telecommunications, computers, and satellite communications. Coverage will be worldwide with focus on France, Federal Republic of Germany, United Kingdom, Italy, Japan, the U.S.S.R., People's Republic of China, Sweden, and the Netherlands. Author

N78-16273*# Rockwell International Corp., Anaheim, Calif. Electronic Devices Div.
INVESTIGATION OF PACKAGE SEALING USING ORGANIC ADHESIVES
K. L. Perkins and J. J. Licari *In* NASA. Marshall Space Flight Center Proc. of the 1977 NASA/ISHM Microelectronics Conf. Nov. 1977 p 77-94 (For availability see N78-16266 07-33) Avail: NTIS HC A08/MF A01 CSCL 09C

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N78-16249 British Library Lending Div., Boston Spa (England).
TWO-DIMENSIONAL ANALYSIS OF IN HOMOGENEOUS PASSIVE RC-NR STRUCTURES
E. Muller and L. Wolf Aug. 1977 10 p refs Transl. into ENGLISH from Nachrtech. Elektronik (West-Germany), v. 26, no. 9, 1976 p 352-354
(BLL-RTS-10866) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

Since direct analytic solution is not readily possible, in the 1960's RC-NR structures were analyzed by a simplified one-dimensional model for some envelope functions. In the mathematical respect a Sturm-Liouville eigen value problem had to be solved, i. e. the partial differential equation was reducible to an ordinary one. Physically, the model was an inhomogeneous RC iterated network with infinitely many terms, but the limits of application of the model were unknown. In 1971 Tanaka and Hattori(1) produced a numerical two-dimensional analysis of the hyperbolic structure from the partial differential equation and reported error up to 35% in the one-dimensional model at 3 DB frequency. A method given uses both models, but here there are inaccuracies. It is for this reason that attention is drawn once again to the fundamental relationships. Author

N78-16250 British Library Lending Div., Boston Spa (England).
TUNING RC REJECTOR FILTERS WITH DISTRIBUTED PARAMETERS
V. D. Dmitriev and A. I. Merkulov Aug. 1977 10 p refs Transl. into ENGLISH from Izv. VUZ Radioielektronika (USSR), v. 14, no. 10, 1971 p 1213-1318
(BLL-RTS-10841) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The possibility is examined of tuning RC filters with uniform distributed parameters by adjusting the notch frequency to either the higher or lower frequency bands. Reasons are given for choosing the rating and the arrangement of the trimming components. The relevant inter-relationships are estimated. Author

N78-16251 British Broadcasting Corp., Kingswood (England). Engineering Div.
THE CSI 1 kW METAL-HALIDE DISCHARGE LAMP: MEASUREMENTS AND PREDICTED EFFECTS OF INTENSITY RIPPLE USING SINUSOIDAL LAMP EXCITATION
E. W. Taylor Dec. 1977 12 p refs
(BBC-RD-1977/46) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

A description is given of measurements of the light intensity ripple characteristics shown by the Thorn CSI 1 kW metal halide discharge lamp when excited from a sinusoidal power source at various frequencies in the range 50 Hz to 1000 Hz. Operating conditions which reduce motion picture film exposure variations to acceptable limits in the presence of this ripple component are discussed. Author

N78-16252 California Univ., Los Angeles.
AN INVESTIGATION OF THE MICROSTRIP CIRCULATOR: A FORM OF PLANAR CIRCUIT Ph.D. Thesis
Taro Yodokawa 1977 152 p
Avail: Univ. Microfilms Order No. 77-23937

A planar circuit that is open at the edges may be used as an efficient radiator of electromagnetic energy, or it may be used as a resonant cavity depending on the electrical parameters of the material and the geometry. A research program was conducted to investigate the possibilities of constructing a circulator in planar circuit form in which the undesirable opposite effects of radiation were minimized. A theoretical and experimental study of a microstrip three-port circulator was conducted. Measurements of not only its usual parameters but also of electromagnetic field configurations within the junction resonator were performed. Analytical field patterns were compared with measured patterns. Dissert. Abstr.

N78-16253 Akron Univ., Ohio.
AN IMPROVED SECOND ORDER METHOD FOR OPTIMAL LOAD FLOW IN ELECTRIC POWER SYSTEMS Ph.D. Thesis
Juan Lambus Bala, Jr. 1977 145 p
AVail: Univ. Microfilms Order No. 77-23439

The reduced Hessian method, which was inherently a second order method, was applied to optimal load flow problems in electric power systems. This method employed Lagrange multipliers to associate the load flow equations to the objective function. Variable weighting factors were employed in the penalty functions used so that the effects of functional inequality constraints could be incorporated. The original large-size Hessian matrix was converted into a smaller size, but equivalent, matrix which was used to update the operating parameters. A procedure was developed for handling the inequality constraints on control variables in order to retain the excellent second order convergence properties of the reduced Hessian method which by itself, could not recognize the effects of inequality constraints. Dissert. Abstr.

N78-16254 Wayne State Univ., Detroit, Mich.
AN EXPERIMENTAL INVESTIGATION OF SOME NEGATIVE DIFFERENTIAL MOBILITY SEMICONDUCTORS Ph.D. Thesis
Wolodymyr Czubatyj 1977 172 p
Avail: Univ. Microfilms Order No. 77-23961

The influence of electronic boundary conditions and hydrostatic pressure on the transport properties of negative differential mobility (NDM) semiconductors was investigated. By controlling the contact properties, various current instabilities are observed that depend primarily on the interfacial electric fields. Once contact effects are separated out, the bulk transport properties of the semiconductors are controlled by hydrostatic pressure. The investigation is directed towards the separation of bulk from contact effects and an elucidation of important conduction band parameters in NDM semiconductors. Emphasis is placed on n-GaAs, n-InP and n-Ge. One important discovery is an understanding of the role that ionized impurity scattering plays in determining the influence of pressure on the peak velocity in the velocity-electric field characteristics of NDM semiconductors. Dissert. Abstr.

N78-16255 Texas Univ., Austin.
FAULT PARTITIONING TECHNIQUES FOR EFFICIENT DIGITAL FAULT SIMULATION Ph.D. Thesis

Sung Hyuk Hong 1977 156 p
Avail: Univ. Microfilms Order No. 77-22970

The first technique, that the idea of which is to identify and simulate only potentially detectable faults out of the total fault list is called potentially detectable fault simulation (PDFS). By means of dynamic fault partitioning (DFP), which is performed in the zero-delay timing model, the fault partitioning overhead is minimized in PDFS simulation. The second technique, called multiple number of faults per pass (MNFP), intends to partition the total fault set into a number of fault groups which can be simulated as multiple faults. In MNFP simulation, an attempt is made to detect a faulty group first, and then locate the single faults inside the group. Two approaches to fault partitioning are made for this technique of fault simulation: probabilistic fault partitioning (PFP), and modular fault partitioning (MFP). Significant savings in simulation time are expected to be realized from MNFP as well as PDFS simulation. Dissert. Abstr.

N78-16256 Syracuse Univ., N. Y.
COMPLEX CONVOLUTION USING RADIX-2 NUMBER THEORETIC TRANSFORMS Ph.D. Thesis
Robert Leland Nevin 1976 96 p
Avail: Univ. Microfilms Order No. 77-24399

Logic circuits are presented which can be used for residue arithmetic modulo any prime number. These circuits rely heavily on recent integrated circuit technology, including the use of large read only memories. Such circuits were combined into arithmetic elements which were specialized to the NTT computations. Methods for input binary-to-residue conversion and output residue-to-binary conversion were specifically addressed. The resulting NTT processor was then compared to similar FFT equipment. The comparison showed that the NTT can save a significant amount of time and or hardware, especially when its intrinsic high precision was required. By treating the selection of prime moduli of NTT's in an unrestricted manner, the availability of many more such moduli were pointed out, than were discussed previously. Dissert. Abstr.

N78-16257 California Univ., Los Angeles.
TOPOLOGICAL CRITERIA FOR ESTABLISHING THE UNIQUENESS OF SOLUTIONS TO THE dc EQUATIONS OF TRANSISTOR NETWORKS Ph.D. Thesis
Richard Ove Nielsen 1977 133 p
Avail: Univ. Microfilms Order No. 77-23908

The presence of a certain topological structure was shown to be a necessary and sufficient condition for a network to possess a unique solution to its dc equations for any choice of network parameter values. An important result in this theory showed how transistor networks could, for the purpose of analysis, be broken apart into smaller subnetworks, which could then be analyzed individually. It was shown how one can then deduce that the original circuit possesses a unique solution to its dc equations, as a consequence of the uniqueness of solutions to the dc equations of the subnetworks. In the event that a given transistor network does not possess the topological structure mentioned previously, results are presented which show how the computational effort required to verify a certain well-known set of necessary and sufficient conditions, which guarantees the uniqueness of solutions to the dc equations of transistor networks, can be reduced. Dissert. Abstr.

N78-16258 Pittsburgh Univ., Pa.
THE USE OF DISTRIBUTED PARAMETER ROTOR MODELS IN ac MACHINE ANALYSIS Ph.D. Thesis
Sheppard Joel Salon 1977 261 p
Avail: Univ. Microfilms Order No. 77-23560

A mathematical model for computing the magnetic field quantities throughout the cross section of a rotating machine is described. Applicable to steady state and non-steady state conditions, the method includes the effects of eddy currents in non-laminated structures and yields a distributed parameter model of the a.c. machine. The concept of a flux equivalent circuit is introduced. In problems which may be considered two dimensional, the flux equivalent circuit is shown to be equivalent to the finite difference expansion of Maxwell's equations. The rotor models are used for both time and frequency domain studies. Substantiating shop data used for model calibration and verification for some of the applications is presented. Dissert. Abstr.

N78-16259 Washington Univ., St. Louis, Mo.
THE FORMULATION AND USE OF DYADIC MUTUAL IMPEDANCE IN RADIATION AND SCATTERING PROBLEMS Ph.D. Thesis
Thomas L. Blakney 1977 127 p
Avail: Univ. Microfilms Order No. 77-26799

Radiation and scattering problems involving perfectly conducting objects were considered in regard to finite dielectric-covered antennas; especially where the dielectric cover is thick in terms of the wavelength. Analytic techniques suitable for solving these types of problems were developed through reviewing the use of vector and scalar potentials in moment method solutions for conducting wire systems and for dielectric systems. The use of the dyadic Green's Function instead of the vector and scalar potential was then formulated for the conducting wire problem. Note was made of the shortcomings of scalar impedance and the concept of dyadic impedance was introduced and discussed when used with the moment method. Dissert. Abstr.

N78-16260 Illinois Univ., Urbana-Champaign.
THERMAL IMAGING BY MEANS OF AN ELECTRON BEAM ADDRESSED ARRAY OF INFRARED BOLOMETERS Ph.D. Thesis
David Richard Hertling 1977 112 p
Avail: Univ. Microfilms Order No. 77-26679

The bolometric vidicon that could provide in the 8-12 micron region of the spectrum the low cost, ruggedness, and simplicity of operation of its visible imaging counterpart, the photoconductive vidicon, was investigated. The development of such a real time thermal imaging device compatible with standard television monitors would greatly enhance the growth of thermal imaging techniques and applications. The thermal image was focused onto a thin planar high resistivity bolometric target. The target, which could be modeled as a two dimensional array of bolometric elements, created a charge analog of the thermal image. This charge analog was then sequentially addressed and read one element at a time by a scanning electron beam to produce the video signal. Dissert. Abstr.

N78-16261 Illinois Univ., Urbana-Champaign.
CAPACITIVE TAP WEIGHT NETWORK SURFACE ACOUSTIC WAVE TRANSDUCERS Ph.D. Thesis
Donald Chester Malocha 1977 96 p
Avail: Univ. Microfilms Order No. 77-26711

A structure for SAW transducer tap weight control using thin film capacitors in a bridge type network was devised. In the capacitive tap weight network (CTWN), thin film capacitors made with an SiO(x) dielectric were fabricated on each tap in the propagation path so no additional substrate area was used. The impulse response shape was controlled by the voltage attenuation on each finger. This provided a large dynamic range of tap weights without phase variation and a uniform beam width which allowed the cascading of two weighted transducers without the use of a multistrip coupler. A model which accurately predicts the multitap CTWN transducer input admittance, insertion loss, thin film losses and electrical Q is presented. Design procedures for capacitive weighted bandpass filters were developed. Dissert. Abstr.

N78-16262 Michigan Univ., Ann Arbor.
PROPERTIES AND APPLICATIONS OF BARITT DEVICES Ph.D. Thesis
Hien Nguyen-Ba 1977 166 p
Avail: Univ. Microfilms Order No. 77-26325

The objective of this study is to gain a better understanding of the BARITT device and to explore its potential applications. The phenomenon of dc negative resistance which occurs in certain types of BARITT devices is studied. Experimental evidence attributes this effect to a small degree of ionization multiplication of carriers in the high field region. It is also shown that n-type Si BARITT devices are able to withstand a higher electric field than p-type Si ones without producing dc negative resistance. A simple theoretical model is presented which gives excellent qualitative agreement with experimental results. Both an approximate analysis and a computer simulation are utilized to evaluate the performance of various BARITT structures and material types. The results show that the n-type GaAs BARITT has a slightly better overall performance than the n-type Si BARITT

device which, in turn, is much better than the p-type Si device. Dissert. Abstr.

N78-16263 Stanford Univ., Calif.
ANALOG SIGNAL PROCESSING ELECTRONICS FOR AN ULTRASONIC IMAGING SYSTEM Ph.D. Thesis
Harry Edward Mussman 1977 243 p
Avail: Univ. Microfilms Order No. 77-25707

Analog signal processing electronics were designed to optimize the image quality of an ultrasonic imaging system using a square piezoelectric transducer array; these electronics form a system with a large dynamic range, high sensitivity, good axial resolution, and the ability to display a manually specified range of signals. A procedure is described to evaluate the limits a given transducer places on the sensitivity and axial resolution of a system; this procedure uses a simplified equivalent-circuit model for a transducer whose parameters may be determined using only electrical measurements and an easily defined reference system. To support the system design, computer-aided analysis programs were written that can run interactively on a system of minimal capabilities such as a desktop calculator. A time domain noise analysis which is useful in evaluating the effects of noise in a nonlinear system is included. To support the integrated circuit design, a v-groove isolated bipolar process was refined to allow the quick fabrication of analog integrated circuits with breakdown voltages as high as 20 V. Dissert. Abstr.

N78-16264*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
CYCLIC AND LOW TEMPERATURE EFFECTS ON MICROCIRCUITS Final Technical Report, Aug. 1975 - Aug. 1977
V. A. Weissflug and E. V. Sisul Aug. 1977 155 p refs
(Contract NAS8-31446)
(NASA-CR-150519) Avail: NTIS HC A08/MF A01 CSCL 09A

Cyclic temperature and low temperature operating life tests, and pre-/post-life device evaluations were used to determine the degrading effects of thermal environments on microcircuit reliability. Low power transistor-transistor-logic gates and linear devices were included in each test group. Device metallization systems included aluminum metallization/aluminum wire, aluminum metallization/gold wire, and gold metallization/gold wire. Fewer than 2% electrical failures were observed during the cyclic and low temperature life tests and the post-life evaluations revealed approximately 2% bond pull failures. Reconstruction of aluminum die metallization was observed in all devices and the severity of the reconstruction appeared to be directly related to the magnitude of the temperature excursion. All types of bonds except the gold/gold bonds were weakened by exposure to repeated cyclic temperature stress. Author

N78-16265*# National Aeronautics and Space Administration, Washington, D. C.
CALCULATION OF THE MAGNETIC FIELD IN THE ACTIVE ZONE OF A HYSTERESIS CLUTCH
M. A. Ermilov and O. M. Glukhov Dec. 1977 15 p refs Transl. into ENGLISH from Electrichestvo (USSR), no. 4, Apr. 1975 p 61-64 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original Doc. Prep. by Moscow Aviation Inst.
(Contract NASw-2791)
(NASA-TM-75184) Avail: NTIS HC A02/MF A01 CSCL 09C

The initial distribution of magnetic induction in the armature stationary was calculated relative to the polar system of a hysteresis clutch. Using several assumptions, the problem is reduced to calculating the static magnetic field in the ferromagnetic plate with finite and continuous magnetic permeability placed in the air gap between two identical, parallel semiconductors with rack fixed relative to the tooth or slot position. Author

N78-16266*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PROCEEDINGS OF THE 1977 NASA/ISHM MICROELECTRONICS CONFERENCE
S. V. Caruso, comp. Nov. 1977 170 p refs Conf. held at Huntsville, Ala., 20-21 Sep. 1977
(NASA-CP-2027) Avail: NTIS HC A08/MF A01 CSCL 09C

Current and future requirements for research, development, manufacturing and education in the field of hybrid microelectronic technology were discussed. For individual titles, see N78-16267 through N78-16280.

N78-16267*# Army Industrial Base Engineering Activity, Rock Island, Ill.
OVERVIEW OF THE TRI-SERVICE HYBRID MICROELECTRONICS MM AND T PROGRAMS
Charles E. McBurney *In* NASA. Marshall Space Flight Center Proc. of the 1977 NASA/ISHM Microelectronics Conf. Nov. 1977 p 3-35 (For availability see N78-16266 07-33)
Avail: NTIS HC A08/MF A01 CSCL 09C

It was stated that the Army has aggressively pursued new hybrid techniques more than either the Navy or Air Force. It has 30 ongoing hybrid projects in various stages of contracting and execution, while the Navy has 6 and Air Force 2. The Army is programming for 8 hybrid projects in fiscal year 1979, the Navy for 5 and Air Force none. In terms of dollars, the Army's fiscal year 1979 program is worth $2.25 million, and the Navy is expected to spend about $1.7 million. Author

N78-16268*# McDonnell-Douglas Electronics Co., Grand Rapids, Mich.
THE ROLE OF APPLICATIONS ENGINEERING IN HYBRID MICROELECTRONICS
C. E. Jones *In* NASA. Marshall Space Flight Center Proc. of the 1977 NASA/ISHM Microelectronics Conf. Nov. 1977 p 37-41 (For availability see N78-16266 07-33)
Avail: NTIS HC A08/MF A01 CSCL 09C

Hybrid microcircuits were examined in regard to their place in the electronic packaging spectrum. The problem of why hybrids are not as widely used as they should be is addressed as the primary concern. Author

N78-16269*# Martin Marietta Corp., Orlando, Fla.
MICROELECTRONICS/ELECTRONIC PACKAGING POTENTIAL
Rene F. Sandeau *In* NASA. Marshall Space Flight Center Proc. of the 1977 NASA/ISHM Microelectronics Conf. Nov. 1977 p 43-46 (For availability see N78-16266 07-33)
Avail: NTIS HC A08/MF A01 CSCL 09C

The trend toward smaller and lighter electronic packages was examined. It is suggested that electronic packaging engineers and microelectronic designers closely associate and give full attention to optimization of both disciplines on all product lines. Extensive research and development work underway to explore innovative ideas and make new inroads into the technology base, is expected to satisfy the demands of the 1980's. Author

N78-16270*# Naval Ocean Systems Center, San Diego, Calif.
COMPARISON OF DOD TAPE AUTOMATED BONDING PROGRAMS
Robert F. Unger *In* NASA. Marshall Space Flight Center Proc. of the 1977 NASA/ISHM Microelectronics Conf. Nov. 1977 p 47-56 refs (For availability see N78-16266 07-33)
Avail: NTIS HC A08/MF A01 CSCL 09C

Tape automated bonding (TAB) shows promise of being the predominant assembly and interconnect technique for microcircuit devices in the 1980's. After briefly reviewing the evolution of TAB, consideration was given to factors influencing and motivating TAB, including current major problem areas. Solutions to these problems are being investigated under five Department of Defense programs. These complementary efforts are discussed and compared. The findings are contrasted against recent improvements and advancements in automated wire bonding. Author

N78-16271*# Army Missile Research and Development Command, Redstone Arsenal, Ala.
MILITARY REQUIREMENTS FOR MICROELECTRONICS: VIEW FROM THE FIELD
Lawrence B. Residori *In* NASA. Marshall Space Flight Center Proc. of the 1977 NASA/ISHM Microelectronics Conf. Nov. 1977 p 58-69 refs (For availability see N78-16266 07-33)
Avail: NTIS HC A08/MF A01 CSCL 09C

During the past decade, the field of military application of microelectronics has grown by leaps and bounds. Costs to develop these systems have taken on a primary role in technology as opposed to previous emphasis on innovative designs. The future of microelectronics is investigated in regard to the military

developer who must insure that a system is developed which can be operated and maintained in an economical manner in a field environment. Author

N78-16272*# Rockwell International Corp., Richardson, Tex.
THE ROLE OF HYBRID CONSTRUCTION TECHNIQUES ON SEALED MOISTURE LEVELS
D. T. Somerville *In* NASA. Marshall Space Flight Center Proc. of the 1977 NASA/ISHM Microelectronics Conf. Nov. 1977 p 71-75 refs Submitted for publication (For availability see N78-16266 07-33)
Avail: NTIS HC A08/MF A01 CSCL 09C

Residual gas analysis techniques were employed to measure the moisture in sealed hybrid packages as a function of substrate attach material, vacuum bake time and sequence, and sealing procedure. It is shown that when room atmospheric exposure is eliminated following the vacuum bakeout moisture levels of less than 1000 ppm may be achieved for modest bake times and solder substrate attach techniques. Suitable moisture levels were achieved for epoxy attached substrates only when seam sealing procedures were employed. Author

N78-16273*# Rockwell International Corp., Anaheim, Calif. Electronic Devices Div.
INVESTIGATION OF PACKAGE SEALING USING ORGANIC ADHESIVES **c32**
K. L. Perkins and J. J. Licari *In* NASA. Marshall Space Flight Center Proc. of the 1977 NASA/ISHM Microelectronics Conf. Nov. 1977 p 77-94 (For availability see N78-16266 07-33)
Avail: NTIS HC A08/MF A01 CSCL 09C

A systematic study was performed to evaluate the suitability of adhesives for sealing hybrid packages. Selected adhesives were screened on the basis of their ability to seal gold-plated Kovar butterfly-type packages that retain their seal integrity after individual exposures to increasingly severe temperature-humidity environments. Tests were also run using thermal shock, temperature cycling, mechanical shock and temperature aging. The four best adhesives were determined and further tested in a 60 C/98% RH environment and continuously monitored in regard to moisture content. Results are given, however, none of the tested adhesives passed all the tests. Author

N78-16274*# General Electric Co., Philadelphia, Pa. Space Div.
A HERMETIC SEALING PROCESS FOR LARGE IRREGULARLY SHAPED HYBRID MICROCIRCUIT ENCLOSURES
M. R. Stahler *In* NASA. Marshall Space Flight Center Proc. of the 1977 NASA/ISHM Microelectronics Conf. Nov. 1977 p 95-110 refs (For availability see N78-16266 07-33)
Avail: NTIS HC A08/MF A01 CSCL 09C

A system for sealing vacuum baked hybrids in a dry inert atmosphere using an overlapping spot resistance weld is described. A unique electrode configuration and fixturing that permits sealing of large and irregularly shaped gold plated Kovar packages to the hermeticity requirements of MIL-STD-883 was discussed. Metallurgical considerations and comparisons to laser sealing were made. Problems encountered during the development and optimization of the process were highlighted. Solutions to plating, fixturing, warpage, weld splatter and cracked bead problems are presented. Author

N78-16275*# Honeywell, Inc., St. Petersburg, Fla. Avionics Div.
METHODS FOR MEASURING PLATING THICKNESSES ON TAB LEAD FRAMES
Michael P. Hagen *In* NASA. Marshall Space Flight Center Proc. of the 1977 NASA/ISHM Microelectronics Conf. Nov. 1977 p 111-121 refs (For availability see N78-16266 07-33)
Avail: NTIS HC A08/MF A01 CSCL 09C

Plating three layer tape lead frames, used for tape automated bonding, offers a challenge to the electroplater because of nonuniform topography. Each lead frame contains large (typically .05 x .05 inch) flat test pads located around the perimeter of the frame. These test pads are electrically connected to the bondable lead frame fingers which extend into an area in the center of the frame called the feature hole. The feature hole exposes these fingers to plating on all sides, while the test pads are exposed on only one side. In addition, the fingers are small in cross section (typically .003 x .0015 inches). Recent thickness measurements indicate that plating around the lead frame fingers is nearly twice as thick as that on test pad areas. Procedures and equipment were developed for measuring the thickness of the deposited material. Discussion was centered on the data obtained using the various measurement techniques and equipment. Author

N78-16276*# Raytheon Co., Andover, Mass.
LASER DRILLING OF VIAS IN DIELECTRIC FOR HIGH DENSITY MULTILAYER LSHI THICK FILM CIRCUITS
T. Cocca and S. Dakesian *In* NASA. Marshall Space Flight Center Proc. of the 1977 NASA/ISHM Microelectronics Conf. Nov. 1977 p 123-137 refs (For availability see N78-16266 07-33)
Avail: NTIS HC A08/MF A01 CSCL 09C

A design analysis of a high density multilevel thick film digital microcircuit used for large scale integration is presented. The circuit employs 4 mil lines, 4 mil spaces and requires 4 mil diameter vias. Present screened and fired thick film technology is limited on a production basis to 16 mil square vias. A process whereby 4 mil diameter vias can be fabricated in production using laser technology was described along with a process to produce 4 mil diameter vias for conductor patterns which have 4 mil lines and 4 mil spacings. B.B.

N78-16277*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SENSITIVITIES OF PARTICLE IMPACT NOISE DETECTION
F. Z. Keister (Hughes Aircraft Co., Culver City, Calif.) and S. V. Caruso *In its* Proc. of the 1977 NASA/ISHM Microelectronics Conf. Nov. 1977 p 139-153 (For availability see N78-16266 07-33)
Avail: NTIS HC A08/MF A01 CSCL 09C

The results of a study on Particle Impact Noise Detection commonly referred to as PIND testing is described. Certain sensitivities of PIND testing as applicable to hybrid microcircuits were determined, and techniques for removing particles from sealed hybrid packages were evaluated. Methods for freeing particles which have become trapped or hung up inside the hybrid package and, therefore, give no PIND test response were examined. Author

N78-16278*# Du Pont de Nemours (E. I.) and Co., Niagara Falls, N. Y.
FACTORS AFFECTING LASER-TRIM STABILITY OF THICK FILM RESISTORS
R. E. Cote and R. C. Headley *In* NASA. Marshall Space Flight Center Proc. of the 1977 NASA/ISHM Microelectronics Conf. Nov. 1977 p 155-162 (For availability see N78-16266 07-33)
Avail: NTIS HC A08/MF A01 CSCL 09C

Various factors affecting precision of trim and resistor stability were considered. The influence of machine operating parameters on resistor performance was examined and quantified through statistically designed experiments for a Q switched YAG laser system. Laser kerf quality was studied by scanning electron microscopy and related to kerf isolation resistance measurements. A relatively simple production oriented, quality control test is proposed for rapid determination of kerf electrical stability. In addition, the effect of cut design and extent of trim on precision and stability were discussed. Author

N78-16279*# Clemson Univ., S.C. Electrical and Computer Engineering Dept.
RELEVANCE OF MICROELECTRONIC EDUCATION TO INDUSTRIAL NEEDS
J. L. Prince and J. W. Lathrop *In* NASA. Marshall Space Flight Center Proc. of the 1977 NASA/ISHM Microelectronics Conf. Nov. 1977 p 163-167 ref (For availability see N78-16266 07-33)
Avail: NTIS HC A08/MF A01 CSCL 09C

The relevance of microelectronic education to industrial needs was evaluated, and four categories were surveyed: (1) facts and rules; (2) skills; (3) personality; and (4) deductive-inductive reasoning. Examples of specific items in each category are given to illustrate their meaning and it was indicated as to which

items in each category are strongly impacted by microelectronics courses and laboratories. B.B.

N78-16280*# North Carolina Agricultural and Technical State Univ., Greensboro.

INNOVATIONS IN MICROELECTRONICS AND SOLID STATE AT NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIVERSITY

Leo Williams, Jr. *In* NASA. Marshall Space Flight Center Proc. of the 1977 NASA/ISHM Microelectronics Conf. Nov. 1977 p 169-177 refs Submitted for publication (For availability see N78-16266 07-33)

Avail: NTIS HC A08/MF A01 CSCL 09C

Research in the following areas is described: (1) Characterization and applications of metallic oxide devices; (2) Electronic properties and energy conversion in organic amorphous semiconductors; (3) Material growth and characterization directed toward improving 3-5 heterojunction solar cells. Author

N78-16281# National Aviation Facilities Experimental Center, Atlantic City, N. J.

REBUILDING CATHODE RAY TUBES Final Report

John W. Aschenbach Oct. 1977 26 p ref

(AD-A047250; FAA-NA-77-14; FAA-RD-77-61) Avail: NTIS HC A03/MF A01 CSCL 09/1

Results from the evaluation of rebuilt tubes as supplied by several CRT rebuilders are summarized. The sample size was not sufficient to conclude that CRT vendors could be qualified to rebuild special CRT's. Perhaps the most useful result of the investigation and testing was the information obtained relative to commercial television CRT improvements to the FAA CRT rebuilding experiments. Author

N78-16282# Rome Air Development Center, Griffiss AFB, N.Y. Dept. of Defense.

FAA LIGHTNING PROTECTION STUDY: HANDBOOK OF INSTALLATION PROCEDURES FOR SELECTED SOLID STATE EQUIPMENTS

Richard M. Cosel, comp. Oct. 1977 100 p refs

(Contract DOT-FA72WAI-356)

(AD-A047730; FAA-RD-77-170) Avail: NTIS HC A05/MF A01 CSCL 09/5

This handbook provides the necessary detailed guidance, to be used in conjunction with information available in the applicable instruction books and other handbooks, for the proper installation of devices for the protection of the listed systems for lightning induced transients in buried cables. The equipments listed are all of the newer solid state design utilizing low voltage control levels interfacing with circuits which can be easily overloaded, resulting in catastrophic failure of components, erroneous status indications and loss of remote control capability. The protective device specified are newly developed leadless versions of a family of transient voltage suppressor diodes. These are mounted in an also newly developed barrier strip with an integral diode holder allowing for ease of maintenance. Author

N78-16283# Raytheon Co., Waltham, Mass. Special Microwave Devices.

MANUFACTURING METHODS AND TECHNOLOGY ENGINEERING HIGH EFFICIENCY, HIGH POWER GALLIUM ARSENIDE READ-TYPE IMPATT DIODES Quarterly Progress Report, 1 Oct. - 31 Dec. 1976

H. R. Chalifour and S. R. Steele Jan. 1977 53 p

(Contract DAAB07-75-C-0045)

(AD-A041533; Rept-0277-1338; QPR-6) Avail: NTIS HC A04/MF A01 CSCL 09/1

The X-band and Ku-band confirmatory sample wafers were processed into dice and evaluated. The confirmatory sample diodes were assembled and tested. Group B testing is being performed on the diodes. Installation and characterization of the thermal resistance testing equipment was completed. The noise measuring equipment was also completed and installed. The fifth operating life test was completed for the Ku-band diodes only. Priority for testing of X-band diodes was assigned to the confirmatory samples, delaying start of the fifth X-band life test. Author (GRA)

N78-16284# Canada Wire and Cable Technology Development Div., Pointe Claire (Quebec).

DEVELOPMENT OF HIGH TEMPERATURE (1250 DEG F) WIRE AND CONNECTORS Final Report, 1 Feb. 1975 - 31 Jan. 1977

Michael A. Dudley, F. Derrick Bayles, and Phillip O. Scadding Jul. 1977 314 p refs

(Contract F33615-75-C-2040; AF Proj. 3145)

(AD-A046406; AFAPL-TR-77-25) Avail: NTIS HC A14/MF A01 CSCL 09/1

This report covers the research and development efforts in Phases I and II of the program to develop high temperature (1250 F) wire and connectors for general purpose aerospace use. Included are sections summarizing the Phase I effort, fabrication and testing of the previously established prime conductor, optimization of the insulation package, connector development and fabrication, and the drafting of the requisite test methods. Author (GRA)

N78-16285# Microwave Associates, Inc., Burlington, Mass.

MM AND T PROGRAM FOR THE ESTABLISHMENT OF PRODUCTION TECHNIQUES FOR HIGH POWER BULK SEMICONDUCTOR LIMITERS Quarterly Report, 23 Sep. - 22 Dec. 1976

Yoginder Anand, Paul Bakeman, Richard Bilotta, and Philip S. Schaffer Jan. 1977 76 p

(Contracts DAAB07-76-C-0039; DAAB07-77-C-0324)

(AD-A047053; ECOM-0039-2; QR-2) Avail: NTIS HC A05/MF A01 CSCL 09/1

The objective of this Manufacturing Methods and Technology Engineering Program is to establish the producibility of the X-band semiconductor bulk limiter and the X-band bulk semiconductor - lower power diode multistage limiter by mass production techniques. During the quarter, X-band semiconductor bulk limiters with power handling capability of 20-30kW were fabricated from new high resistivity silicon and were characterized for their RF performance along with their multistage clean up limiter. Two (2) bulk limiter elements were mounted in a dual slot X-band iris to provide increased bandwidth. A new microwave circuit was implemented to provide the required operating bandwidth for the combined bulk limiter and diode clean up limiter stages. Author (GRA)

N78-16286# Varian Associates, Palo Alto, Calif.

LONG PULSE HIGH EFFICIENCY SWITCH TUBE DEVELOPMENT Final Technical Report, 13 May 1976 - 30 Jun. 1977

Dennis Boilard Griffiss AFB, N. Y. RADC Sep. 1977 60 p

(Contract F30602-76-C-0259)

(AD-A047257; RADC-TR-77-319) Avail: NTIS HC A04/MF A01 CSCL 09/1

This report covers the design, fabrication and initial testing of a linear beam tetrode switch tube. Design goals were 140 kV video output at 100 A load current and 0.08 (0.03 min) duty cycle at pulse lengths up to 300 microsec. Important features are the nonintercepting grid, convergent electron beam passing through the anode (screen grid), high efficiency, and the voltage-depressible collector-probe system. Cooling capability of the collector and probe was improved through a new, computer-aided thermal design which retained approximately the same geometry. The collector-probe system was evaluated up to 100 kV video output at 0.03 duty. GRA

N78-16287# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics.

PERTURBATION THEORY FOR LINEAR ELECTROELASTIC EQUATIONS FOR SMALL FIELDS SUPERPOSED ON A BIAS

H. F. Tiersten Oct. 1977 25 p refs

(Contract N00014-76-C-0368; Grant DAAG29-76-G-0173)

(AD-A047304; TR-22) Avail: NTIS HC A03/MF A01 CSCL 20/3

A perturbation formulation of the equations of linear piezoelectricity for small fields superposed on a bias is obtained from a Green's function representation. It is shown that the resulting equation for the first perturbation of the eigenvalue may be obtained without the use of a Green's tensor or a complete

set of orthogonal eigensolutions. Since the bias enters the constitutive equations, the boundary conditions contain perturbation terms as well as the differential equations. The linear electroelastic equations for small fields superposed on a bias differ from the equations of linear piezoelectricity because the effective material constants of linear electroelasticity have less symmetry than the constants of linear piezoelectricity. Consequently, a perturbation formulation of the linear electroelastic equations for small fields superposed on a bias is presented. It is shown that the effective constants of linear electroelasticity have just the symmetry required for the condition of the orthogonality of linear electroelastic vibrations to hold.
Author (GRA)

N78-16288# Watkins-Johnson Co., Palo Alto, Calif.
ELECTRON BEAM SEMICONDUCTOR L-BAND AMPLIFIER Triannual Report No. 2, 1 Sep. - 31 Dec. 1975
Bruce W. Bell Ft. Monmouth, N. J. ECOM Jul. 1976 32 p
(Contract DAAB07-75-C-13-29; DA Proj. 1S7-62705-AH-94)
(AD-A047111; W-J-22-4142R2; ECOM-75-1329-2) Avail: NTIS HC A03/MF A01 CSCL 09/5

The goal of this program is to develop a 2000 watt L-Band amplifier capable of operating at a 1 percent duty cycle with 25 db gain and an operating lifetime of 10,000 hours. During this period, two EBS diode runs were processed, the target holder, output matching circuit, and output RF window were designed, and four exploratory models were fabricated, evaluated and tested.
Author (GRA)

N78-16289# General Electric Co., Syracuse, N.Y. Electronics Lab.
THERMAL RESISTANCE OF MICROELECTRIC PACKAGES Final Technical Report, 6 Apr. 1976 - 6 May 1977
James W. Anslow, Gene K. Baxter, and J. Walter Brouillette Griffiss AFB, N. Y. RADC Oct. 1977 108 p refs
(Contract F30602-76-C-0228)
(AD-A047110; RADC-TR-77-321) Avail: NTIS HC A06/MF A01 CSCL 09/5

Computer simulation, IR and electrical temperature measurements were compared and evaluated for special thermal test packages. The junction size was varied and elevated chip-carrier temperatures were studied to determine their effects on the thermal characteristics. In addition a comparison of the film-carrier chip interconnection technique versus wire-bonding techniques was made. In general, the data showed that thermal resistance increased significantly with elevated temperatures and with decreasing junction size. Thermal time constants increased with elevated temperature and increasing junction size. Little difference was found between the film carrier and wire-bond interconnection techniques when the chip is bonded to a chip-carrier, but the film carrier is significantly better if the chip is heat sunk only through its leads.
Author (GRA)

N78-16290# Watkins-Johnson Co., Palo Alto, Calif.
ELECTRON BEAM SEMICONDUCTOR L-BAND AMPLIFIER Final Report, 12 May 1975 - Dec. 1976
Bruce W. Bell Jul. 1977 44 p
(Contract DAAB07-75-C-1329)
(AD-A047052; W-J-22-4142R3; ECOM-75-1329-F) Avail: NTIS HC A03/MF A01 CSCL 09/5

An EBS L-Band amplifier has been developed with characteristics making it ideally suited for IFF power amplification applications. These include high peak output power, high gain, high reliability and small size. Devices were tested at up to 1000 W peak at 1% duty and 1500 watts peak output power at 0.1% duty, with 23 db gain, a 50 MHz bandwidth and a 50% target efficiency. The diode source impedance of 3 ohms is transformed by a quarter wave cavity up to a 50 ohm output impedance.
Author (GRA)

N78-16291# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
FLOATING DECK GRID MODULATOR Interim Technical Report, Mar. - Jun. 1977
D. V. Savage Nov. 1977 14 p
(Contract DAAB07-77-C-2647)
(AD-A047051; ECOM-77-2647-1; ITR-1) Avail: NTIS HC A02/MF A01 CSCL 09/5

A preliminary block diagram at the modulator has been developed. The preliminary study of the 50 kV isolation pulse transformer indicates that in order to meet stability requirements, it will be necessary to clip the oscillations on the secondary and regulate the pulse top level. Three primary drive configurations are being considered.
Author (GRA)

N78-16292# Army Communications-Electronics Engineering Installation Agency, Fort Huachuca, Ariz.
DIGITAL TRANSMISSION EVALUATION PROJECT UNIVERSAL LOOP MULTIPLEXER ULM-101 Interim Report, Feb. - Jul. 1977
James E. Hamant, O. P. Connell, and Henry S. Walczyk Sep. 1977 82 p refs
(AD-A046963; CCC-CED-77-DTEP-016) Avail: NTIS HC A05/MF A01 CSCL 09/5

Testing of the ULM-101 loop multiplexer was initiated to establish a data base and assessment of the continuous variable slope delta (CVSD) and log CVSD modulation techniques and to evaluate its ability to interface with existing signals typical of those in use in the Defense Communications System (DCS). Twelve tests of voice channel performance were conducted and in general the minimum DCS performance specifications for voice channels were met by the ULM-101 when operating at 32 KBPS and 64 KBPS sampling rates. Performance was marginal at 16 KPBS and unsuitable at 8 KBPS. Ability of the ULM-101 to interface with VFCT, SF signalling and MF signalling equipment was evaluated to be marginal.
Author (GRA)

N78-16293# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
LARGE SCALE INTEGRATED CIRCUITS FOR MILITARY APPLICATIONS Final Report, Jan. - Nov. 1976
Glenn W. Preston May 1977 170 p refs Revised
(Contract DAHC15-73-C-0200)
(AD-A047178; P-1244; AD-E500009; IDA/HQ-76-18885) Avail: NTIS HC A08/MF A01 CSCL 09/5

The gap which exists between the current state of integrated circuit technology and its use in military systems is broadly discussed and analyzed. Two categories of cost are analyzed: the direct life cycle cost of the integrated circuit assemblies (development, acquisition, spares and repairs), and the systems support life cycle costs. The dependence of these costs on the physical characteristics of the integrated circuits is discussed. The economic and physical characteristics of several types of integrated circuits are reviewed, particularly as they depend on the level of circuit integrations, and the effect of these characteristics on the total life cycle cost of several classes of military systems is examined. The potential for cost avoidance or performance improvement through the application of current integrated circuit technology to military systems is estimated as several billion dollars for weapons systems and intelligence gathering systems are now in advanced development or in the early stage of production. Various steps that might be taken by DoD to partially achieve these cost reductions are discussed, the chief one being a study of the feasibility of designing a family of integrated circuits which could replace a significant fraction of the circuits which would otherwise be used.
GRA

N78-16294# TRW, Inc., Lawndale, Calif. Semiconductor Div.
PRODUCTION ENGINEERING MEASURE FOR AN INTEGRATED CIRCUIT POWER AMPLIFIER 600-1000 MHz, FOR TACTICAL RADIO EQUIPMENT, VOLUME 1 Final Report, 29 Mar. 1972 - 31 Mar. 1977
Roger C. DeBloois Apr. 1977 207 p
(Contract DAAB05-72-C-5844)
(AD-A047159) Avail: NTIS HC A10/MF A01 CSCL 09/5

This program was directed towards developing and establishing techniques for manufacturing broadband high power UHF amplifiers. Specifically, a 30 watt amplifier that covered the 600 to 1000 MHz instantaneous bandwidth was to be produced. The work involved; (1) design and characterization of transistors; (2) optimization of internal transistor matching networks; (3) design and fabrication of broadband impedance matching circuits; (4) study and design of broadband power splitters/combiners; (5) batch fabrication of microstrip circuits on alumina; (6) mechanical package design; (7) development of amplifier

assembly techniques. During the program a number of engineering models were fabricated and tested prior to the production run. The production amplifiers incorporated changes based on the performance of these engineering models. Electrical, mechanical and environmental tests were performed as required by the specifications. Author (GRA)

N78-16295# Naval Ocean Systems Center, San Diego, Calif.
BEHAVIOR OF THE ADAPTIVE LINE ENHANCER DURING INITIAL ADAPTATION Technical Report, Sep. 1976 - Jan. 1977
Baldassare A. Bologna 11 Oct. 1977 15 p refs
(XF11101100)
(AD-A047036; NOSC/TR-156) Avail: NTIS HC A02/MF A01 CSCL 09/3

The behavior of the Adaptive Line Enhancer (ALE) during initial adaptation is analyzed analytically via the direct solution of the Widrow-Hoff least-mean-square (LMS) algorithm. The result shows that the initial transient response of the weight vector is approximately equal to 2mu/T times the cross correlation vector of the input, i.e., W sub l(t) = 2mu/T Integral from tau = delta - lT to tau = t of (x(tau) x(tau-delta-lT)d tau), where mu is the adaptation constant, delta is the bulk delay of the filter, l is the weight index and T is the sampling period or an element delay. Author (GRA)

N78-16296# Westinghouse Electric Corp., Pittsburgh, Pa.
THEORY AND DESIGN OF ELECTRICAL ROTATING MACHINERY Annual Report, 1 Nov. 1976 - 31 Oct. 1977
W. J. Carr, Jr. Nov. 1977 26 p refs
(Contract N00014-72-C-0432)
(AD-A047177; AR-5) Avail: NTIS HC A03/MF A01 CSCL 09/3

The objective of this program is to contribute toward new and improved rotating machines for Naval applications, with emphasis on superconduting machinery. Work has been performed on the theory of ac losses in multifilament superconductors and experiments were made to check the theory. A list of publications and abstracts of scientific papers published under the contract is given. Some work on the design of the iron circuit of a normal homopolar motor was concluded. Author (GRA)

N78-16297# Westinghouse Electric Corp., Pittsburgh, Pa.
GALLIUM ARSENIDE VERTICAL CHANNEL INSULATED GATE FIELD-EFFECT TRANSISTOR Annual Technical Report, Jan. - Dec. 1976
M. C. Driver, D. A. Tremere, and D. L. Barrett 1 Feb. 1977 69 p refs
(Contract N00014-75-C-0418)
(AD-A047108; Rept-77-9F7-VMIST-R1) Avail: NTIS HC A04/MF A01 CSCL 09/1

The technologies necessary to fabricate a power, microwave frequency, vertical channel, gallium arsenide insulated gate field-effect transistor have been further developed. Planar devices that show FET action have been fabricated. The etching technology for a V-groove version of the vertical channel device has been explored. Author (GRA)

N78-16298# Lincoln Lab., Mass. Inst. of Tech., Lexington.
COAXIAL MAGNETRON SPECTRA AND INSTABILITIES
24 Jun. 1977 74 p ref
(Contracts F19628-76-C-0002; DOT-FA71WAI-242)
(AD-A046292; ATC-74; FAA-RD-77-31) Avail: NTIS HC A04/MF A01 CSCL 09/1

Application of advanced radar clutter rejection techniques to FAA airport surveillance and enroute radars is constrained by inherent instabilities and spectral properties of the device used in the radar transmitter to generate high level RF pulse energy, and the degree to which its spectrum can be influenced by the circuit in which it operates. Coaxial magnetrons are believed to be spectrally pure, controllable and stable, and to embody other characteristics such as long life, which make them attractive replacements for the magnetrons presently employed. This report summarizes the results of extensive measurements made on a conventional S-band magnetron (presently employed in the ASR-7 radar) and a coaxial magnetron of equivalent pulse and power rating to compare their instabilities and spectral properties. Author (GRA)

N78-16299# Gorwara Associates, San Mateo, Calif.
STUDY ON MILLIMETER WAVE MIXERS Final Report
Ashok K. Gorwara Apr. 1977 26 p refs
(Contract N00173-76-C-0195)
(AD-A041525) Avail: NTIS HC A03/MF A01 CSCL 09/5

For years waveguide-type mixers were the only ones available at frequencies above 18 GHz. However, more recently design techniques that were previously considered only suitable at microwave frequencies have been extended to millimeterwave frequencies. These developments can be separated into two groups. True balanced mixers in waveguide have been built using packaged diodes combined with coaxial IF circuits. These mixers differ from conventional balanced mixers in that they do not employ a separate hybrid such as a short-slot hybrid or a magic tee. Rather the diodes are arranged in a bridge circuit thus leading to a compact mixer with excellent LO-RF isolation. This type of mixer is capable of covering entire waveguide bands and high IF frequencies. The second development of importance is the emergence of mixers using integrated circuit techniques at millimeter-wave frequencies. These developments have shown that balanced and image reject mixers are feasible using microstrip on sapphire, quartz and Duroid up to and beyond 60 GHz. GRA

N78-16300# Tennessee Univ., Knoxville. Dept. of Electrical Engineering.
STUDY OF LOW-FREQUENCY EXCESS NOISE HYBRID THICK-FILM RESISTORS M.S. Thesis
J. P. Baker, E. J. Kennedy, and R. W. Tucker, Jr. 23 Feb. 1977 108 p refs
(Contract W-7405-eng-26)
(ORNL-SUB-3961-2; TR-EE/EL-8) Avail: NTIS HC A06/MF A01

A method of measuring the excess low frequency noise due to direct current in hybrid thick film resistors is presented. Guidelines for low noise design of thick film resistors were also included. Excess noise is present in a resistor in addition to thermal noise when there is direct current flow in the resistor. An expression was developed to indicate the dependence of excess noise on resistor dimensions as well as direct current and frequency. Details of an experimental system for measuring excess noise from the thick film resistors were shown. From the experimental data the ratio of excess noise to thermal noise was computed at each current level and frequency. Using this ratio the constants in the expression for excess noise were then determined. When trimming was required, the air abrasive trim on the top hat style resistor produced the least increase in excess noise. ERA

N78-16301# Allis-Chalmers Mfg. Co., Milwaukee, Wis.
CURRENT LIMITING FUSE STUDY Final Report
Martin Hudis, B. Bhargava, and D. A. Wycklendt Jun. 1977 60 p refs
(EPRI-EL-453(6-77)) Avail: NTIS HC A04/MF A01

New element design, gas impregnation, and composite polymer sand fillers are reported. The new element design is based on a freestanding cylinder approach with a large surface area-to-volume ratio which provides better heat transfer and higher arcing gradients. New filler mixtures also increase arcing gradients and improve interruption capability which will improve overall performance of the fuse and increase the current rating. The full-size experiments (15 kV, 200 A) demonstrated significant improvements in the average arc voltage and rating capability when compared to existing state of the art technology. ERA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N78-16302 Texas Univ., Austin.
A DEGENERATE EVOLUTION EQUATION FOR FLUID FLOW IN MULTI-POROUS MEDIA Ph.D. Thesis

Robert Leo Dawes 1977 61 p
Avail: Univ. Microfilms Order No. 77-22937

A degenerate evolution equation is developed as a linear model for fluid flow phenomena in a porous medium. The medium to which the model applies is characterized by the presence at each point of several distinct porous structures superimposed upon and communicating with one another. The possibility that individual porosities may vanish in some regions accounts for the degeneracy of the equation. Semigroup methods are used to prove that physically reasonable assumptions on the data of the model guarantee the existence of solutions continuous in the time variable. Spatial regularity of the solution in the interior and at the boundary of the region is obtained from several assumptions about the data, including a very weak control on the vanishing of the porosity functions. Dissert. Abstr.

N78-16303 Pittsburgh Univ., Pa.
INTERPHASE MASS TRANSFER BETWEEN TWO CO-CURRENT LIQUID FLOWS Ph.D. Thesis
I-Cheng Chu 1977 144 p
Avail: Univ. Microfilms Order No. 77-23555

Based on boundary layer theory and a semi-spherical droplet model of interfacial disturbances, an approach has been developed. Experimental runs for the ethylacetate-acetic acid-water system were carried out to test the validity of the theoretical solutions. The calculated average oscillating frequency is found to increase with initial solute concentration, indicating more intense interfacial disturbances with higher initial solute concentration. Boundary layer thickness appears to decrease with initial solute concentration. Both oscillating frequency and mass transfer coefficient for transfer from the ethylacetate phase to the water phase are larger than that for transfer in the opposite direction. The experimental results indicate the possible existence of a uniform concentration zone in the immediate vicinity of the interface. Dissert. Abstr.

N78-16304 Syracuse Univ., N. Y.
AXIAL OSCILLATORY MOTION OF A CYLINDRICAL ROD IN A LIQUID Ph.D. Thesis
Ashok Vasudev Naimpally 1976 189 p
Avail: Univ. Microfilms Order No. 77-24398

The main thrust was directed toward analyzing the motion executed by a freely oscillating, vertical, finite rod in a liquid; specifically, efforts were directed towards finding a relationship between the extent of damping that occurs during the motion of the rod, and the kinematic viscosity of the liquid. The equations of motion and continuity of the fluid were simplified by using the assumptions of an infinite extent of fluid, constant values of density and viscosity of the fluid as well as the condition of no slip at the boundary of the solid rod and the fluid. For the case of forced oscillations of the infinite rod, the standard Duhamel's method was used to obtain a mathematical description of the motion of the infinite rod. Numerical computations were carried out for one case of forced oscillations of the rod in order to illustrate the solution obtained. Dissert. Abstr.

N78-16305 Arkansas Univ., Fayetteville.
GAS-SIDE MASS-TRANSFER COEFFICIENT AND INTERFACIAL PHENOMENA OF FLAT-BLADED SURFACE AGITATORS Ph.D. Thesis
James Robert Reinhardt 1977 106 p
Avail: Univ. Microfilms Order No. 77-23358

The interfacial phenomena and the mass transfer coefficient on the gas side for mechanically-driven surface agitators were studied. Aqueous sulfuric acid of 3.5 normality and ammonia in air was the chemical system used in experiments to resistance to mass transfer to the gas side. Ammonia was the component being transferred. The interfacial agitation took place inside a cylindrical tank with the agitators being four-bladed impellers, each blade being flat and vertical. The liquid disturbance caused by the agitation was separated into surface waves which formed logarithmic spiral patterns, flat sheets thrown outward from each blade, and drops and globs which separated from the sheets. The coefficient was found to increase with increasing impeller speed. The coefficient was slightly greater when the blades were fully submerged than when half submerged. Dissert. Abstr.

N78-16306 Ohio State Univ., Columbus.
VISUAL STUDIES IN DRAG REDUCTION Ph.D. Thesis
William Richard Ramakka 1977 138 p
Avail: Univ. Microfilms Order No. 77-24686

Drag reduction was studied by taking high speed motion pictures of the turbulent flow in the wall region of a 2.54 cm diameter pipe. The fluid motions were made visible by suspending small magnesium oxide particles in the fluid. One polymer and one soap solution were studied: poly(ethylene oxide) in trichloroethylene and aluminum dioctoate in trichloroethylene. Both pre-drag reducing and drag reducing flows were studied. The bulk of the visual work was done at a solvent Reynolds number of 50,000, but some films were taken at solvent Reynolds numbers of 20,000 and 90,000. No differences were observed between the effects of the polymer and the soap additives, even though the physical properties of the two solutions are different. The velocity profiles, turbulence intensities, and Reynolds stresses of the aluminum dioctoate solution appeared to be no different than would be expected for a polymer solution. Polymer and soap solutions could not be distinguished from one another by viewing them. This evidence lends support to the idea that the mechanism for drag reduction is the same for both the polymer and soap solutions. Dissert. Abstr.

N78-16307 Rensselaer Polytechnic Inst., Troy, N. Y.
ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF AN EVAPORATING MENISCUS Ph.D. Thesis
Frederick Joseph Renk 1977 168 p
Avail: Univ. Microfilms Order No. 77-23800

An analytical and experimental investigation was conducted of a horizontal, two dimensional evaporating meniscus operating at steady state. The meniscus was formed at the exit of the gap between two horizontal, flat plates. Heat was conducted through the top glass plate to the meniscus interline where evaporation occurred. The heat was supplied by a resistance source vapor deposited on the glass substrate. The temperature distribution of the substrate surface was measured using the technique of resistance thermometry. Using a one-dimensional model for the temperature distribution in the glass substrate an estimate was obtained for the evaporative heat dissipation. The shape of the evaporating meniscus was observed through the glass substrate using the technique of interferometry. The meniscus profile was determined by measuring the location of interference fringes photographed at 350 X magnification. Dissert. Abstr.

N78-16308 Pittsburgh Univ., Pa.
INCOMPRESSIBLE FLOW BETWEEN FINITE DISKS Ph.D. Thesis
Maurice Lawrence Adams, Jr. 1977 111 p
Avail: Univ. Microfilms Order No. 77-23553

The primary laminar steady flow field that occurs in an incompressible, isoviscous, Newtonian fluid which is contained between two finite parallel disks, one rotating at constant velocity and the other stationary, with line source flow or sink flow located concentric to the axis of rotation is discussed. The first analysis results from a thin film assumption and produces a single-parameter family of solutions which are applicable to thin films in the absence of backflow. The second analysis is general, containing all terms of the Navier-Stokes equations, and produces a four-parameter family of solutions. Solutions with the general analysis are in agreement with the thin film analysis for high throughflow and low rotation, and are in agreement with existing infinite-disk zero-throughflow solutions for low throughflow and high rotation. Dissert. Abstr.

N78-16309 Texas Univ., Austin.
ANALYSIS OF BUBBLE GROWTH AND BOILING HEAT TRANSFER FOR LIQUID METALS IN MAGNETIC FIELDS Ph.D. Thesis
Clement Po-Ching Wong 1977 111 p
Avail: Univ. Microfilms Order No. 77-23049

To increase heat transfer and reduce pumping losses, boiling potassium was proposed as a heat transfer medium in the blanket of fusion power reactors. However, the presence of the magnetic field may alter the boiling process due to the presence of Lorentz forces. An analytical study of an isolated bubble growing in a superheated liquid metal under a uniform magnetic field was

made by numerically solving the equations of motion. Results show that in the presence of a strong magnetic field the bubble growth would become increasingly elongated in shape and the volume would be less than that of the nonmagnetic case. Single bubble results were then used to estimate the nucleate boiling heat transfer of potassium under a uniform magnetic field. The results show that the presence of a strong magnetic field would shift the nucleate boiling curve to the right.
Dissert. Abstr.

N78-16310 Cincinnati Univ., Ohio.
AN IMPOSED NUMERICAL ANALYSIS OF TRANSIENT TWO-PHASE PHENOMENA USING A SLIP MODEL Ph.D. Thesis
Adrian Michel Tentner 1975 288 p
Avail: Univ. Microfilms Order No. 77-24826

Results of a combined analytical and experimental effort are presented which studied the behavior of one dimensional piping systems under transient two phase flow conditions. A one dimensional, thermal equilibrium transient two phase analytical model incorporating slip was developed. The model was solved using the method of characteristics. The derivation of equations incorpoating slip is presented, and the well-posedness of the model was analyzed in a systematic way. The model was found to be well-posed over the range of parameters. The techniques developed for the treatment of abrupt area changes, phase changes, and critical flow in the context of the method of characteristics are presented. Special attention was devoted to the prediction of critical flow using the model. Dissert. Abstr.

N78-16311 Virginia Polytechnic Inst. and State Univ., Blacksburg.
TEMPERATURE DISTRIBUTION AROUND A PROPAGATING FATIGUE CRACK Ph.D. Thesis
James Chen Hsieh 1977 122 p
Avail: Univ. Microfilms Order No. 77-24514

A theoretical study of the heat transfer phenomena from a propagating crack tip and an experimental investigation to verify the theoretical results were conducted. A temperature distribution equation based on theories of fracture mechanics and heat transfer was developed. Measurements of temperature at the crack tip were made by taking thermal pictures or thermograms with a thermovision camera. The measured results were compared with the computed results. The magnitude of the temperature at and near a propagating crack tip depends upon the specimen geometry, loading, crack extension, and propagating velocity of the crack for a given material, but the heat flow patterns, i.e., the isotherms and the temperature ridge curves are closely related to the velocity of crack propagation only. Dissert. Abstr.

N78-16312 Missouri Univ., Rolla.
NUMERICAL SOLUTION OF THE COMPLETE NAVIER-STOKES AND ENERGY EQUATIONS FOR DEVELOPING CHANNEL FLOW INCLUDING THERMAL RADIATION FREE CONVECTION AND VARIABLE VISCOSITY Ph.D. Thesis
Russell Ralph Beckmeyer 1977 433 p
Avail: Univ. Microfilms Order No. 77-23684

The simultaneous development of temperature and velocity profiles in the entrance region of flat horizontal ducts was studied by numerical methods. Solutions were obtained for laminar, steady state, two dimensional flow in both a parallel plate channel and an open channel. Three problems were considered: (1) the effects of free convection, thermal radiation, and variable viscosity were included in the analysis using the complete Navier-Stokes and energy equations (with Rosseland approximation), (2) problem (1) was applied to glass forehearth simulation, and (3) for the situation of negligible axial radiation and conduction, the results from the Rosseland approximation were compared with those from the exact expression for radiation. Dissert. Abstr.

N78-16313 George Washington Univ., Washington, D. C.
CRYPTOSTEADY-FLOW THRUST AUGMENTATION Ph.D. Thesis
Theodoros Costopoulos 1977 178 p
Avail: Univ. Microfilms Order No. 77-20081

Both, the cross sectional shape of the rotor discharge nozzle and the graduality of the interpenetration of the interacting flows during cryptosteady flow induction are included in a wide-strip interaction model which can be extended to account for whatever mixing the interacting flows may undergo during pressure exchange. A relation is developed between the spin angle and the pressure exchange amplitude as represented by the compatibility parameter of the axial momentum equation. The effect of mixing after deflection and on that of the secondary-to-primary density ratio in constant-area interactions is discussed.
Dissert. Abstr.

N78-16314 Ohio State Univ., Columbus.
AN IMPACT OF A FLUID-FILLED SPHERICAL SHELL WITH A SHALLOW SPHERICAL SHELL OF LARGER RADIUS: A MODEL FOR HEAD INJURY Ph.D. Thesis
Johnson Olawale Oladunni 1977 224 p
Avail: Univ. Microfilms Order No. 77-24680

A mathematical modelling of a nonpenetrated type of head impact process in a crash involving a moving vehicle was simulated by imposing a negative acceleration impulse on a vehicle possessing initial speeds of 10 mph and 50 mph. A vehicle occupant wearing only a lap-type belt was assumed receiving a head impact during the collision. Mathematical expressions which lead to one hundred and seventy-five differential equations govern the motion of the vertebral column. The results obtained from the numerical solutions of these equations adequately predicted the instantaneous body positions before a head impact.
Dissert. Abstr.

N78-16315 Rensselaer Polytechnic Inst., Troy, N. Y.
A NEW APPROACH TO THE DETECTION OF MALKUS TRANSITIONS IN A HORIZONTAL LAYER OF FLUID HEATED FROM BELOW Ph.D. Thesis
Hossein Parsapour 1977 142 p
Avail: Univ. Microfilms Order No. 77-23797

The existence of the Malkus transitions in a horizontal layer of fluid heated from below was examined. An optical technique was used which related such transitions to an independently measurable physical parameter of the flow patterns in the heated layer. Using time-lapse photography, pictures of the flow patterns were taken through the transparent upper boundary of the apparatus. In each test, sufficient time was allowed for the fluid layer to reach thermal equilibrium. Only the steady-state results were used in the analysis. The predominant horizontal scale of the flow obtained from the optical apparatus demonstrated the existence of five transitions at Rayleigh numbers between 5000 and 550,000. The results also appeared to support Busse's multi-alpha solutions for the variational problem formulated to derive an upper bound on heat transport by convection in a heated fluid layer. Dissert. Abstr.

N78-16316 Ohio State Univ., Columbus.
CROSSFLOW OVER A POROUS CIRCULAR CYLINDER WITH UNIFORM BLOWING AT THE SURFACE Ph.D. Thesis
Thomas Henry Reif 1977 279 p
Avail: Univ. Microfilms Order No. 77-24688

Two free stream conditions, Re = 4100 and 6200, and five dimensionless blowing rate parameters, were studied via hot wire measurements of the external velocity field to investigate the cross flow over a porous circular cylinder with uniform blowing at the surface. Time-averaged velocity profiles, at several radial positions, were obtained from the front to the rear stagnation point. The analytical study employed the Galerkin method to obtain an approximate solution for the flow field around the entire circumference of the cylinder. The theory was found to give good agreement with the experiments close to the surface of the cylinder and in the entire flow field upstream of separation. The predicted flow fields were found to be in poor agreement with the experiments downstream of separation and away from the wall. Dissert. Abstr.

N78-16317*# B & K Engineering, Inc., Towson, Md.
AXIALLY GROOVED HEAT PIPE STUDY
Jul. 1977 103 p refs
(Contract NAS5-22562)
(NASA-CR-156678; BK012-1009) Avail: NTIS HC A06/MF A01 CSCL 20D

A technology evaluation study on axially grooved heat pipes is presented. The state-of-the-art is reviewed and present and future requirements are identified. Analytical models, the Groove

Analysis Program (GAP) and a closed form solution, were developed to facilitate parametric performance evaluations. GAP provides a numerical solution of the differential equations which govern the hydrodynamic flow. The model accounts for liquid recession, liquid/vapor shear interaction, puddle flow as well as laminar and turbulent vapor flow conditions. The closed form solution was developed to reduce computation time and complexity in parametric evaluations. It is applicable to laminar and ideal charge conditions, liquid/vapor shear interaction, and an empirical liquid flow factor which accounts for groove geometry and liquid recession effects. The validity of the closed form solution is verified by comparison with GAP predictions and measured data. Author

N78-16318 Stevens Inst. of Tech., Hoboken, N. J.
A STUDY OF THE LINEAR STABILITY PROBLEM FOR VISCOUS INCOMPRESSIBLE FLUIDS IN CIRCULAR GEOMETRIES BY MEANS OF MATRIX-EIGENVALUE APPROACH Ph.D. Thesis
Frederick Wright Cotton 1977 86 p refs
Avail: Univ. Microfilms Order No. 77-26931

A set of basis functions and the difficulties still to be resolved in the calculation of some of the matrix elements were discussed. The principal work was in pipe flow. In the course of the testing of the completed portions of the programming for the annulus, an earlier calculation by Salwen and Grosch for Poiseulle flow in a pipe (Hagen-Poiseuille flow) was redone. A minor error in that calculation was found and corrected. The revised results agree with the numerical integration results of Lessen, Sadler, and Liu to within four or five significant figures. The newest work was a study of Hagen-Poiseuille flow combined with rigid body rotation. Hagen-Poiseuille flow was stable to linear disturbances, and rigid body rotation was stable to both linear and nonlinear disturbances. Dissert. Abstr.

N78-16319 Washington State Univ., Pullman.
UNSTEADY DETONATIONS RESULTING FROM FIRST-ORDER PHASE TRANSFORMATIONS Ph.D. Thesis
Ronald Lee Rabie 1977 148 p
Avail: Univ. Microfilms Order No. 77-25788

A simple thermodynamic system is constructed having a single first order phase transformation. This system is shown to support self sustaining waves under a variety of boundary conditions given a metastable initial state. These waves are unsteady in any single inertial reference frame unless the boundary conditions are adjusted to generate the Chapman-Jouguet solution. It is shown that the Chapman-Jouguet solution is a special case of the general boundary value problem for this system. The material is assumed to be viscous and reactive but the possible consequences of letting the coefficient of viscosity vanish are discussed. The existence of an eigenvalue detonation is demonstrated for the system when the viscosity and rate function are different from zero. Dissert. Abstr.

N78-16320 Illinois Univ., Urbana-Champaign.
EXPERIMENTAL STUDIES OF FLOW-THROUGH POROUS ELECTRODES Ph.D Thesis
Brian Eugene Gracon 1977 161 p
Avail: Univ. Mcrofilms Order No. 77-26670

Three types of flow-through porous electrode behavior were studied experimentally: (1) the effect of process variables such as flow rate and electrode properties on the limiting current and collection effectiveness of the electrode at low and high flow rates; (2) the overall currents and current distributions for single and multiple reaction systems, and (3) the effect of nonideal electrodes on electrode behavior. The experiments have led to a clarification of the different regimes of mass transfer control of the porous electrode. Procedures are described for useful engineering design criteria. Dissert. Abstr.

N78-16321 Stanford Univ., Calif.
LAMINAR FREE CONVECTION ON A VERTICAL POROUS PLATE WITH TRANSPIRATION AND BINARY DIFFUSION Ph.D. Thesis
Pradip Girishchandra Parikh 1977 149 p
Avail: Univ. Microfilms Order No. 77-25712

The effects of transpiration and binary diffusion on the laminar free convection boundary layer adjacent to a vertical porous plate were studied both analytically and experimentally. A general two dimensional boundary layer program, based on a finite difference procedure was modified and adapted for obtaining solutions to the governing equations of the problem. The solutions included property variations as well as the thermodynamic coupling effects of thermal diffusion and diffusion thermo in binary helium-air and CO2-air boundary layers. In the experiments, the profiles of temperature and concentration adjacent to a vertical porous plate were determined by simultaneous application of thermocouple probing and Mach-Zehnder interferometry. Dissert. Abstr.

N78-16322 Washington State Univ., Pullman.
NUMERICAL AND EXPERIMENTAL STUDY OF GAS-PARTICLE FLOWS IN ORIFICES AND VENTURIS: APPLICATION TO FLOWMETER DESIGN Ph.D. Thesis
Mrityunjai Prasad Sharma 1977 160 p
Avail: Univ. Microfilms Order No. 77-25794

A computational and experimental investigation was made of gas-particle flow through orifices and Venturis. Emphasis was placed on the flowmetering aspects of these geometries. The particle-source-in-cell model was developed for modeling steady two dimensional gas-particle flows through an orifice. The flow field was solved numerically using the pressure velocity formulation for the gas flow and Lagrangian approach for the particle motion. A quasi one dimensional model was developed for gas-particle flow through a Venturi. The gas flow field solution was obtained using the conservative variable formulation. The numerical results showed that for large Stokes number flows, particles do not affect the gas pressure field. If Stokes number is small, particles do affect the pressure field significantly, and the pressure drop was found to be varying linearly with the particle loading. Dissert. Abstr.

N78-16323 Iowa State Univ. of Science and Technology, Ames.
DEVELOPMENT OF TURBULENCE IN PULSATILE, NONUNIFORM FLOW Ph.D. Thesis
Withaya Yongchareon 1977 115 p
Avail: Univ. Microfilms Order No. 77-26021

The development of turbulence in both steady and pulsatile flow through an axially symmetric obstruction located in a tube was studied experimentally. Most of the experiments were conducted in rigid-walled tubes but some tests were performed in flexible tubes. The general flow characteristics in one streamlined obstruction were investigated in detail. Also, two different geometries, a hollowed plug and an orifice, having the same percentage area reduction, were used to study the effect of geometry on transition from laminar to turbuulent flow. The effect of pulsatile flow on transition was investigated through a wide range of a dimensionless frequency parameter (alpha parameter). General flow characteristics, breakdown of vortices, and transition in flow through both obstructed and unobstructed tubes were also included. Dissert. Abstr.

N78-16324 Illinois Univ., Urbana-Champaign.
INCOMPRESSIBLE FLOW PAST WEDGES AT HIGH REYNOLDS NUMBERS Ph.D. Thesis
Norman Raymond Warpinski 1977 142 p
Avail: Univ. Microfilms Order No. 77-26775

The basic free streamline flow field is established through two discrete parameters which describe the inviscid flow around the body and the wake. The viscous flow processes such as the boundary layer buildup, turbulent jet mixing, and recompression are individually analyzed and attached to the inviscid flow in the sense of the boundary layer concept. It is found that the reattachment point behaves as a saddle point singularity for the system of equations describing the recompressive viscous flow processes and this behavior is exploited for the establishment of the overall flow field. Detailed results such as the base pressure, pressure distributions on the wedge and the geometry of the wake are determined as functions of the wedge angle. The influence of the initial boundary layer thickness as well as the spread rate parameter within the turbulent mixing region is demonstrated. Dissert. Abstr.

N78-16325*# Mississippi State Univ., Mississippi State.
NUMERICAL SOLUTION OF THE COMPRESSIBLE NAVIER-STOKES EQUATIONS USING DENSITY GRADIENTS AS

ADDITIONAL DEPENDENT VARIABLES M.S. Thesis
Jang-Hyuk Kwon Dec. 1977 85 p refs
(Grant NGR-25-001-055)
(NASA-CR-155563) Avail: NTIS HC A05/MF A01 CSCL 20D

Numerical solution of two dimensional, time dependent, compressible viscous Navier-Stokes equations about arbitrary bodies was treated using density gradients as additional dependent variables. Thus, six dependent variables were computed with the SOR iteration method. Besides formulation for pressure gradient terms, a formulation for computing the body density was presented. To approximate the governing equations, an implicit finite difference method was employed. In computing the solution for the flow about a circular cylinder, a problem arose near the wall at both stagnation points. Thus, computations with various conditions were tried to examine the problem. Also, computations with and without formulations are compared. The flow variables were computed on 37 by 40 field first, then on an 81 by 40 field. Author

N78-16326*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF MASS ADDITION ON BLUNT-BODY BOUNDARY-LAYER TRANSITION AND HEAT TRANSFER
George E. Kaattari Jan. 1978 67 p refs
(NASA-TP-1139; A-7169) Avail: NTIS HC A04/MF A01 CSCL 20D

The model bodies tested at Mach number 7.32 were hemispheres, blunt cones, and spherical segments. The mass addition consisted of air ejected through porous forward surfaces of the models. The experimental data consisted of heat transfer measurements from which boundary layer transitions were deduced. The data verified various applicable boundary layer codes in the laminar and transitional flow regimes. Empirical heating rate data correlations were developed for the laminar and turbulent flow regimes. Author

N78-16327*# Dynatherm Corp., Cockeysville, Md.
HEAT PIPE DEVELOPMENT
Walter Bienert 31 Jul. 1973 67 p refs
(Contract NAS5-11455)
(NASA-CR-156669; DTM-73-7) Avail: NTIS HC A04/MF A01 CSCL 20D

The objective of this program was to investigate analytically and experimentally the performance of heat pipes with composite wicks--specifically, those having pedestal arteries and screwthread circumferential grooves. An analytical model was developed to describe the effects of screwthreads and screen secondary wicks on the transport capability of the artery. The model describes the hydrodynamics of the circumferential flow in triangular grooves with azimuthally varying capillary menisci and liquid cross-sections. Normalized results were obtained which give the influence of evaporator heat flux on the axial heat transport capability of the arterial wick. In order to evaluate the priming behavior of composite wicks under actual load conditions, an 'inverted' glass heat pipe was designed and constructed. The results obtained from the analysis and from the tests with the glass heat pipe were applied to the OAO-C Level 5 heat pipe, and an improved correlation between predicted and measured evaporator and transport performance were obtained. Author

N78-16328# Weapons Research Establishment, Salisbury (Australia).
THEORY OF TRANSONIC GAS GUNS
L. M. Sheppard Aug. 1977 45 p refs
(WRE-TR-1877(W); AR-000-936) Avail: NTIS HC A03/MF A01

Analytical methods for predicting the muzzle velocity of compressed gas guns are reviewed. Steady adiabatic expansion theory, quasi-steady theory and unsteady theory are all examined, with emphasis placed on simplified analytical methods applicable to subsonic and transonic muzzle velocities. Formulae are obtained and compared with numerical results from a full theoretical treatment of the gas flow. The comparisons show that the analytic results are effective and can be used for gun design. The effects of atmospheric counter pressure are treated separately and a method for correcting the predicted velocity is given. An analysis of data from actual subsonic guns highlights the importance of muzzle pressure reflections in reducing the retarding pressure at low subsonic speeds. The observed muzzle velocities are about 10% below the muzzle velocities predicted by theory. Nitrogen, helium, and hydrogen are compared as potential driver gases for transonic guns. Author

N78-16329*# Sigma Research, Inc., Richland, Wash.
TWO-PHASE WORKING FLUIDS FOR THE TEMPERATURE RANGE 50 TO 350 C Final Report
Elric W. Saaski and Peter C. Owzarski Jun. 1977 103 p refs
(Contract NAS3-20222)
(NASA-CR-135255) Avail: NTIS HC A06/MF A01 CSCL 20D

The decomposition and corrosion of two-phase heat transfer liquids and metal envelopes have been investigated on the basis of molecular bond strengths and chemical thermodynamics. Potentially stable heat transfer fluids for the temperature range 100 C to 350 C have been identified, and reflux heat pipes tests initiated with 10 fluids and carbon steel and aluminum envelopes to experimentally establish corrosion behavior and noncondensable gas generation rates. Author

N78-16330# Pennsylvania State Univ., State College. Applied Research Lab.
COLLAPSE OF TURBULENT WAKES IN STABLY STRATIFIED MEDIA
S. Hassid 10 Aug. 1977 34 p refs
(Contract N00017-73-C-1418)
(AD-A047174; TM-77-237) Avail: NTIS HC A03/MF A01 CSCL 20/4

A simple turbulent energy model and a calculation procedure are proposed, which are able to reproduce the main features of the collapse of turbulent wakes behind towed or self propelled bodies in stratified environments. The predictions of the model are shown to be in good agreement with the detailed experimental data of Lin and Pao, as well as with the flow visualization experiments of other workers. Author (GRA)

N78-16331# United Technologies Research Center, East Hartford, Conn.
A METHOD FOR COMPUTING FLOWS OVER AN OGIVAL BODY Final Report, Feb. 1976 - Jul. 1977
P. R. Eiseman, R. Levy, and H. McDonald Jul. 1977 51 p refs
(Contract N00019-76-C-0314)
(AD-A047183; UTRC/R77-912536-8) Avail: NTIS HC A04/MF A01 CSCL 20/4

A method for computing three-dimensional flow over an ogival body at angle of attack is described. An approximate set of governing equations is given for viscous flows which have a primary flow direction. A two-level second-order accurate marching procedure is presented for general equations. With this procedure, a three-dimensional turbulent flow can be solved in any coordinate system by marching along the assumed primary flow direction. General tube-like coordinates are developed for a class of geometries applicable to flows between tubular surfaces. The coordinates are then specialized to the flow field bounded between an ogival body at angle of attack and its bow shock. Unlike the ogival body surface, the bow shock surface is not known in advance of the solution but instead must be computed as the solution develops. One marching step of the solution process is broken down into several steps. First, the bow shock surface is discretely extended by an iteration of explicit local solutions. The bow shock surface is then smoothly extended to provide a best fit to the discrete shock data. Tube-like coordinates are generated and finally the second order numerical scheme is applied to advance the fully viscous solution to the next station. In addition, some preliminary computational results were obtained. Specifically, the code was applied to subsonic boundary layers, purely supersonic flow with shocks, and mixed subsonic-supersonic flow. Author (GRA)

N78-16332# RAND Corp., Santa Monica, Calif.
FEASIBILITY OF A SPECIAL-PURPOSE COMPUTER TO SOLVE THE NAVIER-STOKES EQUATIONS Interim Report
E. C. Gritton, W. S. King, I. Sutherland, and R. S. Gaines Jun. 1977 75 p refs Workshop held at Santa Monica, Calif., 9-10 Mar. 1977

(AD-A047243; R-2183-RC) Avail: NTIS HC A04/MF A01 CSCL 20/4

This report summarizes the feasibility of developing a special-purpose computer to solve the Navier-Stokes equations. The conclusions suggest that a special-purpose, parallel-processor machine capable of important fluid dynamics simulations might be technically and economically feasible in the early 1980 time period. The report presents a conceptual design for such a computer, an analysis of how it can be used to solve the Navier-Stokes equations, and performance estimates. GRA

N78-16333# Idaho Univ., Moscow. Graduate School.
STUDY OF THE MEAN PARTICLE DIAMETER AS RELATED TO THE PARTICLE SIZE DISTRIBUTION AND THE HEAT TRANSFER RATE FROM TUBES IMMERSED IN A FLUIDIZED BED M.S. Thesis
Roger Neil Henry Apr. 1977 76 p refs Sponsored by ERDA
(TID-27676) Avail: NTIS HC A05/MF A01

Heat transfer from electrically heated bare stainless steel tubes to an air-fluidized bed of glass beads was investigated. The glass beads were 90 percent true spheres and ranged from 0.074 to 1.19 mm in diameter. The inside diameter of the fluidizing vessel was 15.24 cm (6 in.). Five 250-W electrical heaters were strategically placed within the vessel to heat the bed material. Heat transfer rates were measured for particle size distributions whose mean values were the same even though one distribution was skewed toward smaller diameter particles, while the other distribution was skewed toward larger diameter particles. A comparison of the heat transfer rate between these two beds was used to determine if the heat transfer rate for a given bed could change even though the mean diameter for the particle distribution in that bed did not change. Eight mean particle diameter techniques (average, geometric, harmonic, length, surface, volume, weight, and volume-surface) were studied, and changes in the heat transfer rate were identified for six of these techniques. ERA

N78-16334# Argonne National Lab., Ill. Chemistry Div.
HYCSOS: A CHEMICAL HEAT PUMP AND ENERGY SYSTEM BASED ON METAL HYDRIDES
D. M. Gruen, I. Sheft, G. Lamich, M. Mendelsohn, L. Charlson, A. Knox, R. McBeth, J. Nixon, and F. Schreiner Jun. 1977 45 p refs
(Contract W-31-109-eng-38)
(ANL-77-39) Avail: NTIS HC A03/MF A01

The HYCSOS chemical heat pump and energy conversion system based on metal hydrides are described. The HYCSOS thermal energy storage and recovery modes; the chemical heat pump heating and cooling modes as well as the energy conversion mode are discussed in detail with the aid of heat transfer fluid and hydrogen flow diagrams. The thermodynamic efficiencies of the two metal hydride system were calculated for the heat pump and conversion modes. Design and construction features of a demonstration test facility which utilizes four stainless steel tanks holding 10 lbs. each of either LaNi5 or CaNi5 were given. The operation, instrumentation and control of the system were detailed with the aid of photographs, drawings and a system layout diagram. Initial operation of the system has shown that 33 moles of hydrogen can be transferred from CaNi5 at approximately 100 C to LaNi5 at approximately 40 C and recovered from LANI5 at approximately 8 C to reform CANI5H4 at 40 C with cycle times approaching 2 minutes for 50 percent hydrogen transfer. ERA

N78-16335# New York Univ., N. Y. Mathematics and Computing
SURVEY OF NUMERICAL METHODS FOR COMPRESSIBLE FLUIDS
G. A. Sod Jun. 1977 67 p refs
(Contract EY-76-C-02-3077)
(COO-3077-145) Avail: NTIS HC A04/MF A01

The finite difference methods of Godunov, Hyman, Lax-Wendroff (two-step), MacCormack, Rusanov, the upwind scheme, the hybrid scheme of Harten and Zwas, the antidiffusion method of Boris and Book, and the artificial compression method of Harten are compared with the random choice known as Glimm's method. The methods are used to integrate the one-dimensional equations of gas dynamics for an inviscid fluid. The results are compared and demonstrated that Glimm's method has several advantages. ERA

N78-16336# Michigan State Univ., East Lansing. Dept. of Civil Engineering.
THE EFFECT OF RELEASED GASES ON HYDRAULIC TRANSIENTS Final Report, 1 Sep. 1974 - 31 Aug. 1977
David C. Wiggert and Mark J. Sundquist 31 Aug. 1977 131 p refs
(Grant NSF ENG-74-06653)
(PB-272899/6) Avail: NTIS HC A07/MF A01 CSCL 20D

Flow situations occur in long pipelines where the fluid contains gas in the dissolved state; under transient conditions, with extreme pressure fluctuations, gas release by convective diffusion can occur, resulting in a developing two-component flow regime. Transient flow data was obtained in an experimental pipeline 967 ft in length and 0.083 ft in diameter. The fluid was water saturated with air or carbon dioxide (2 to 130% by volume N.T.P.). Recorded pressure-time histories revealed patterns characteristic of a developing two-phase flow: attenuation and delay of cyclic response and damping of high frequency components. A separate bench top experiment was conducted which provided a qualitative assessment of gas release in a closed vessel in which the fluid was subjected to sudden pressure change and agitated flow conditions. GRA

N78-16337# National Bureau of Standards, Washington, D. C. Mechanics Div.
FLOW MEASUREMENT IN OPEN CHANNELS AND CLOSED CONDUITS, VOLUMES 1 AND 2 Final Report
Lafayette K. Irwin, ed. Oct. 1977 982 p refs Symp. held at Gaithersburg, Md., 23-25 Feb. 1977
(PB-273535/5; NBS-SP-484-Vol-1; NBS-SP-484-Vol-2; LC-77-14243) Avail: NTIS HC E14/MF A01 CSCL 20D

The wide range and complexity of problems and potential solutions that must be considered for useful flow measurements are emphasized by the papers contained in these proceedings. Fifty-three presentations cover: characteristics of new and improved instruments; applications of traditional and new measuring devices in field environments; procedures for identifying and analyzing errors or uncertainties in data under specific conditions; uses of physical and numerical models; politico-economic changes that affect international standards for flow measurement; and philosophical bases for making measurements. The fluids of most interest are water and waste water, petroleum and related refined products, air, natural gas and stack gas. The most significant trend relfected in these presentations is the general awareness that uncertainties in measured quantities at the lowest point in the measurement chain, i.e., in the field or plant, are more important than accuracy statements derived from controlled laboratory studies. Other trends in evidence are the rising importance of turbine meters for use as transfer standards and in-line measurments of liquids and gases in filled pipes and the increasing number of applications for acoustics and laser technology for flow measurements in both open channels and closed conduits. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N78-16338 Michigan Univ., Ann Arbor.
PULSED HOLOGRAPHIC INTERFEROMETRY OF HIGH DENSITY Z-PINCH AND EXPLODING LITHIUM WIRE PLASMAS Ph.D. Thesis
Paul David Rockett 1977 243 p
Avail: Univ. Microfilms Order No. 77-26349

Pulsed holographic interferometry at both Lambda = 694.3 nm and lambda = 347.2 nm was used to investigate an

exploding lithium wire plasma and a high density helium Z-pinch plasma. The interferometer optical source was a modified ruby laser. The fractional fringe technique was applied to generate high resolution interferograms. Study of the exploding wire plasma revealed electron densities exceeding 10 to the 19th power e-/cucm during a pinch. However, significant simultaneous neutral densities were inferred, making accurate quantitative electron density measurement impossible via single wavelength interferometry. Exploding wire dynamics showed three stages of plasma development: pinch, neutral condensation, and diffuse expansion. Helium Z-pinch radial electron density profiles showed an axially uniform, steep density gradient, reproducible plasma with a peak density of 4 x 10 to the 19th power e-/cucm.
Dissert. Abstr.

N78-16339*# Case Inst. of Tech., Cleveland, Ohio. Engineering Design Center.
MICROELECTRONICS BIOINSTRUMENTATION SYSTEMS Final Report, 1 Oct. 1976 - 30 Sep. 1977
Wen H. Ko 30 Sep. 1977 95 p refs
(Grant NGR-36-027-053)
(NASA-CR-155524) Avail: NTIS HC A05/MF A01 CSCL 14B

Microelectronic bioinstrumentation systems to be employed in the Cardiovascular Deconditioning Program were developed. Implantable telemetry systems for long-term monitoring of animals on earth were designed to collect physiological data necessary for the understanding of the mechanisms of cardiovascular deconditioning. In-flight instrumentation systems, microelectronic instruments, and RF powering techniques for other life science experiments in the NASA program were studied. Author

N78-16340*# Drexel Univ., Philadelphia, Pa. Dept. of Chemistry.
PERFORMANCE EVALUATION OF ELECTROCHEMICAL CONCENTRATION CELL OZONESONDES
A. L. Torres and A. R. Bandy Nov. 1977 28 p refs
(Grant NsG-6007)
(NASA-CR-155561) Avail: NTIS HC A03/MF A01 CSCL 14B

Laboratory calibrations of more than a hundred electrochemical concentration cell (ECC) ozonesondes were determined relative to UV-photometry. The average intercept and slope, 0 plus or minus 5 nb and 0.96 plus or minus 0.06, respectively, indicate reasonable agreement with UV photometry, but with considerable variation from one ECC ozonesonde to another. The time required to reach 85% of the final reaction to a step-change in ozone concentration was found to average 51 seconds. Application of the individual calibrations to 20 sets of 1976 flight data reduced the average of the differences between ozonesonde and Dobson spectrophotometric measurements of total ozone from 3.9 to 1.3%. A similar treatment of a set of 10 1977 flight records improved the average ECC-Dobson agreement from -8.5 to -1.4%. Although systematic differences were reduced, no significant effect on the random variations was evident. Author

N78-16341*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SYSTEM FOR MEASURING THE PULSE HEIGHT DISTRIBUTION OF ULTRAFAST PHOTOMULTIPLIERS
James B. Abshire Dec. 1977 28 p refs
(NASA-TM-78027; G7802-F2) Avail: NTIS HC A03/MF A01 CSCL 09C

A system for measuring the pulse height distribution of gigahertz bandwidth photomultipliers was developed. This system uses a sampling oscilloscope as a sample-hold circuit and has a bandwidth of 12 gigahertz. Test results are given for a static crossed-filed photomultiplier tested with a demonstration system. Calculations on system amplitude resolution capabilities are included for currently available system components. Author

N78-16342*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CHARACTERIZATION OF GIGAHERTZ (GHz) BANDWIDTH PHOTOMULTIPLIERS
James B. Abshire and H. Edward Rowe Dec. 1977 50 p refs Submitted for publication
(NASA-TM-78028; G7802-F5) Avail: NTIS HC A03/MF A01 CSCL 09E

The average impulse response, root-mean-square times jitter as a function of signal level, single photoelectron distribution, and multiphotoelectron dark-count distribution have been measured for two static crossed-field and five electrostatic photomultipliers. The optical signal source for the first three of these tests was a 30 picosecond mode-locked laser pulse at 0.53 micron. The static crossed-field detectors had 2-photoelectron resolution, less than 200 ps rise times, and rms time jitters of 30 ps at the single photoelectron level. The electrostatic photomultipliers had rise times from 1 to 2.5 nanoseconds, and rms time jitters from 160 to 650 ps at the same signal level. The two static crossed-field photomultipliers had ion-feedback-generated dark pulses to the 50-photoelectron level, whereas one electrostatic photomultiplier had dark pulses to the 30-photoelectron level.
Author

N78-16343*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SYSTEMS FOR MEASURING RESPONSE STATISTICS OF GIGAHERTZ BANDWIDTH PHOTOMULTIPLIERS
James B. Abshire and H. Edward Rowe Dec. 1977 33 p refs Submitted for publication
(NASA-TM-78029; G7703-X31) Avail: NTIS HC A03/MF A01 CSCL 09C

New systems have been developed for measuring the average impulse response, the pulse-height spectrum, the transit-time statistics as a function of signal level, and the dark-count spectrum of gigahertz bandwidth photomultipliers. Measurements showed that the 0.53 microns pulse used as an optical test source had a 30 picoseconds and less than 70 ps pulse width. Calibration data showed the system resolution to be less than 20 ps for root mean square transit-time measurements. Test data for a static crossed-field photomultiplier showed 2-photoelectron resolution and less than 30-ps time jitter over the 1- to 100-photoelectron range. Author

N78-16344# Nagoya Univ. (Japan). Inst. of Plasma Physics.
DIRECT-READING TYPE MICROWAVE INTERFEROMETER
Kiyokata Matsuura, Junji Fujita, Atsushi Ogata, and Kiichiro Haba Oct. 1977 15 p refs
(IPPJ-T-29) Avail: NTIS HC A02/MF A01

A microwave interferometer was developed and applied to the electron density measurement on a hybrid stellerator Tokamak device. The interferometer generates an output voltage proportional to the number of fringe shifts and also output pulses which indicate the change of electron density for the convenience of data processing, where the resolution is a quarter of fringe shift. The principle is based on the digitization of fringe shifts utilizing the phase detection of microwave signals with two-level modulation of source frequency. With this system and 70 GHz microwave source, a change of electron density as rapid as about 2 x 10 to the 13th power/cu cm in 1 ms was measured. Author

N78-16345*# ITT Aerospace/Optical Div., Fort Wayne, Ind.
ADVANCED VERY HIGH RESOLUTION RADIOMETER Final Engineering Report
[1976] 305 p refs
(Contract NAS5-21900)
(NASA-CR-156682) Avail: NTIS HC A14/MF A01 CSCL 14B

The advanced very high resolution radiometer development program is considered. The program covered the design, construction, and test of a breadboard model, engineering model, protoflight model, mechanical structural model, and a life test model. Special bench test and calibration equipment was also developed for use on the program. Author

N78-16346# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FERROELECTRIC RADIATION DETECTORS
L. S. Kremenchugskiy 5 Jul. 1977 543 p refs Transl. into ENGLISH of the book "Segnetoelektricheskiy Priyemniki Izluchen-iya" Kiev, Naukova Dumka, 1971 p 1-234
(AD-A046669; FTD-ID(RS)T-0846-77) Avail: NTIS HC A23/MF A01 CSCL 17/5

Contents: Thermal Radiation Detectors; Bases of Physics of

Ferroelectric Materials; Pyroelectric Coefficient and Dielectric Constant of Ferroelectric Materials; The Theory of Pyroelectric Radiation Detectors; Pyroelectric Radiation Detectors; Ferroelectric Bolometers; Equipment and Procedures for Determining the Characteristics of Material and Parameters of Ferroelectric Radiation Detectors; Limited Applications of Ferroelectric Thermal Radiation Detectors. GRA

N78-16347# Air Force Geophysics Lab., Hanscom AFB, Mass.
ON THE INSTALLATION, OPERATION, DATA REDUCTION, AND MAINTENANCE OF VHF ELECTRONIC POLARIMETERS FOR TOTAL ELECTRON CONTENT MEASUREMENTS
K. E. Eis, J. A. Klobuchar, and C. Malik 31 May 1977 67 p refs
(AF Proj. 4643)
(AD-A047037; AFGL-TR-77-0130; AFGL-IP-256) Avail: NTIS HC A04/MF A01 CSCL 04/1

This report gives practical, explanatory information on the installation, operation, and maintenance of VHF Electronic Polarimeters and on the reduction of data for computations of ionospheric total electron content (TEC). It should be used by Air Weather Service maintenance and observer personnel engaged in making real-time TEC measurements, and it can also be used by personnel engaged in making TEC measurements for scientific studies. Many aspects of the experimental problems associated with TEC measurements are presented in this report. Author (GRA)

N78-16348# Radio Corp. of America, Camden, N. J. Information Processing and Recording Systems.
TEST AND EVALUATION OF TAPE TRANSPORTS AND TECHNIQUES FOR AIRBORNE HIGH DATA RATE DIGITAL RECORDING Final Report, 20 May 1975 - 29 Apr. 1977
Oliver E. Bassette, Robert B. Resek, and LeRoy W. Ferber Jul. 1977 153 p
(Contract F33615-75-C-1145)
(AD-A046912; AFML-TR-76-131) Avail: NTIS HC A08/MF A01 CSCL 14/3

Test, evaluation and analysis were made on two magnetic tape transports. These data were compared against the Air Force requirements to record Digital Data generated by an Airborne Synthetic Aperture Radar Set/Analog to Digital Converter/Duty Cycle Compression System for (AN/UPD-X). An Airborne Digital Tape Transport configuration is proposed based on these data and analysis. Performance and performance margins are given or estimated. Magnetic tape evaluation data is also analyzed and a tape drop-out model is presented with a proposed Error Detection and Correction (EDAC) system which will allow very high bit packing densities (two billion bits per cubic inch) at low bit error rates with uncertified magnetic tape. Author (GRA)

N78-16349# Science Applications, Inc., Santa Ana, Calif.
THE IMPLICATIONS OF HOLOGRAPHIC DISPLAYS ON THE METHODS OF DATA ACQUISITION AND PROCESSING
Kenneth A. Haines 20 Mar. 1977 51 p refs
(Grant NSF APR-76-21771)
(PB-272367/4; NSF/RA-770215) Avail: NTIS HC A04/MF A01 CSCL 06L

Diagnostic and monitoring data collected by medical instrumentation is usually in a form dictated by easy acquisition. For holographic (three dimensional) presentation schemes, this data is often of little use or must be extensively modified. The capabilities and limitations of appropriate holographic displays are established, the ideal data required to generate holograms are determined, and modifications to present devices for the data collection are suggested. The study shows that an ideal system using a holographic display often requires quite different instrumentation and processing methods than are currently envisioned. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N78-16350 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A THEORETICAL ANALYSIS OF RESONATOR MODES IN THE PRESENCE OF HOMOGENEOUS MEDIA Ph.D. Thesis
Glenn Roy Doughty, Jr. 1977 210 p
Avail: Univ. Microfilms Order No. 77-24051

An analysis based on a derivation, which begins with Maxwell's equations and displays the required assumptions, of a pair of integral equations involving the tangential fields on the resonator mirrors is presented. This pair of equations is specialized to apply to paraxial resonators with perfectly conducting mirrors. The result of the specialization is a pair of integral, eigenvalue equations for the current distributions induced on the resonator mirrors. After further specializing them to resonators for which the spatial dependence of the modes separate these integral equations are solved using a straightforward technique based on a variational principle. This technique, which employs a novel method of obtaining modal expansion functions, reduces the analysis to a homogeneous matrix equation that is solved using well-known numerical methods. Dissert. Abstr.

N78-16351 Ohio State Univ., Columbus.
THEORETICAL STUDY OF THE TURBULENCE-INDUCED SCINTILLATION OF A DIRTY LASER BEAM Ph.D. Thesis
Donald Dean Duncan 1977 173 p
Avail: Univ. Microfilms Order No. 77-24620

The temporal scintillation spectrum of a laser beam which has propagated through the turbulent atmosphere was predicted. Use was made of the extended Huygens-Fresnel principle in deriving a very general but compact mathematical expression for the temporal scintillation spectrum of an unspecified source field with an arbitrarily shaped extended receiver aperture. This formula, which is restricted to the weak turbulence regime, was then applied to the analysis of several situations of contemporary interest. Specifically the analysis was directed toward the description of the effects of such phenomena as localized turbulence, off-axis detectors, and the use of a laser beam which is blemished in a deterministic sense. Spectra obtained under these conditions were shown to display increased sensitivity to the path distribution of the turbulence strength. Dissert. Abstr.

N78-16352 Rochester Univ., N. Y.
STUDY OF A TWO-LEVEL SYSTEM IN SODIUM USING LASER OPTICAL PUMPING Ph.D. Thesis
Mary Lancaster Citron 1977 148 p
Avail: Univ. Microfilms Order No. 77-25438

Using two frequency stabilized dye lasers and a sodium atomic beam, an isolated two level system is created and a series of experiments are carried out. The line-shape of this system and the way in which this lineshape is power broadened is determined under very carefully controlled conditions. The optical pumping techniques used to establish this two level system are also studied to determine their efficiency in obtaining and maintaining the level system. As part of these experiments a state-of-the-art CW dye laser was constructed. Dissert. Abstr.

N78-16353*# National Aeronautics and Space Administration, Washington, D. C.
SELECTED DEVELOPMENTS IN LASER WIRE STRIPPING
Nov. 1977 39 p refs
(NASA-SP-5107) Avail: NTIS HC A03/MF A01 CSCL 20E

The operation of mechanical and thermal strippers and the early development of laser wire strippers are reviewed. NASA sponsored development of laser wire stripping for space shuttle includes bench-type strippers as well as an advanced portable hand-held stripper which incorporates a miniaturized carbon dioxide laser and a rotating optics unit with a gas-jet assist and debris exhaust. Drives and controls girdle the wire and slit the remaining slug without manual assistance. This unit can strip wire sizes 26 through 12 gage. A larger-capacity hand-held unit for wire sizes through 1/0 gage was built using a neodynium-doped yttrium aluminum garnet (Nd:YAG) laser. The hand-held units have a flexible umbilical cable to an accompanying cart that carries the power supply, gas supply, cooling unit, and the controls. Author

N78-16354*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PRELAUNCH TESTING OF THE GEOS-3 LASER REFLECTOR ARRAY
P. O. Minott, M. W. Fitzmaurice, J. B. Abshire, and H. E. Rowe Jan. 1978 53 p refs
(NASA-TP-1138; G7702-F19) Avail: NTIS HC A04/MF A01 CSCL 20E

The prelaunch testing performed on the Geos-3 laser reflector array before launch was used to determine the lidar cross section of the array and the distance of the center of gravity of the satellite from the center of gravity of reflected laser pulses as a function of incidence angle. Experimental data are compared to computed results. Author

N78-16355*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIODE LASER SPECTRA OF CCl2F2 NEAR 10.8 MUON M: AIR-BROADENING EFFECTS
D. E. Jennings Nov. 1977 13 p refs
(NASA-TM-78041) Avail: NTIS HC A02/MF A01 CSCL 20E

Laboratory spectra of CCl2F2 in the 10.8 micron region was recorded, using a tuneable diode laser spectrometer. Effects of air-broadening at pressures up to 48 Torr show that spectral structure should be exhibited under high resolution at altitudes as low as 19 Km. The single line, pressure-broadening coefficient for CCl2F2 was estimated to be 8 MHz/Torr FWHM. Author

N78-16356*# Fairchild Industries, Inc., Germantown, Md.
NTS-2 RETROREFLECTOR ARRAY Final Report
Apr. 1977 49 p
(Contract NAS5-23604)
(NASA-CR-156684; Rept-906-FR-3001) Avail: NTIS HC A03/MF A01 CSCL 20E

The NTS-II Laser Retroreflector consists of a honeycomb tray onto which are mounted 44 fused silica cube corners with a 50-millimeter hexagonal entrance pupil and single infrared cube. A thermal shield with a highly relfective outer surface and a black inner surface was incorporated to shroud the assembly protecting it from extreme high temperature exposure thus reducing cube corner thermal distortions to a minimum. A dummy retroreflector, utilizing simulated aluminum cube corners was fabricated and vibration tested to qualification levels to substantiate the integrity of the tray and cube mounting clips. This dummy was further used in the spacecraft spin balance test. The flight Laser Retroreflector was tested to the flight level vibration spectrum to verify that the unit will survive its expected vibration environment. During this test several GFE cube corners exhibited slight crazing at the clip support mounting holes. These cubes were reworked and retested and proved to be satisfactory. Author

N78-16357# Boeing Aerospace Co., Seattle, Wash.
HIGH POWER LASER COUPLING Final Report
R. B. Hall, W. E. Maher, D. J. Nelson, and D. B. Nichols Jun. 1977 182 p refs
(Contract F29601-76-C-0030)
(AD-A046947; AD-E200000; AFWL-TR-77-34) Avail: NTIS HC A09/MF A01 CSCL 20/5

A photoinitiated pulsed chemical laser was developed for laser effects studies. The threshold conditions for forming absorbing plasmas at atmospheric pressure were extensively studied for both wavelengths and seven materials, and were measured in terms of both irradiance and fluence requirements. All metal targets studied, absorbed a nearly constant energy above the plasma threshold. Radially spreading plasma and the resulting spatial heating profile were measured by inverting the time dependent temperature at r = 0. Author

N78-16358# General Electric Co., Philadelphia, Pa. Space Div.
LOW REPETITION RATE COPPER VAPOR LASER Final Report, Jun. 1976 - May 1977
Robert S. Anderson, Robert J. Homsey, and Thomas W. Karras Sep. 1977 100 p refs
(Contract N00014-76-C-0975)
(AD-A047197) Avail: NTIS HC A05/MF A01 CSCL 20/5

The program has resulted in a significant advance in the state-of-the-art. A laser module was demonstrated at a PRF of 1.0 kHz with a 12.12 mJ per pulse output, which is a factor of 7 greater than the prior art. The laser was operated consistently at a PRF as low as 700 Hz. Analysis of experimental data for a range of tube diameters and PRF values show that output pulse energy scales linearly with the active lasing volume. Significantly, no physical limit to this volumetric scaling was observed during the program. It has been concluded that a laser system for producing greater than 50 mJ per pulse is feasible using two laser modules. A brassboard design can be assembled with moderate risk using electronic components within the present state-of-the-art. Author (GRA)

N78-16359# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
RESEARCH IN LASER PROCESSES Semiannual Report, 1 Aug. 1976 - 31 Jan. 1977
A. V. Phelps and A. C. Gallagher 25 Jul. 1977 35 p refs
(Contract N00014-76-C-0123)
(AD-A047107) Avail: NTIS HC A03/MF A01 CSCL 20/5

Numerical models of electric discharges in Na-Xe mixtures have been developed in order to examine the utility of this system for high efficiency, high power, visible lasers. Although the models are incomplete, metal vapor-rare gas discharges continue to appear promising for this application. The detailed models of the time development of the cathode fall of a high pressure discharge have been completed. Measurements and analyses of rate coefficients for electron excitation of 02 and N2 to metastable states are being studied. Measurements have been completed of the spectral intensity of scattered light at wavelengths near the resonance line when Na vapor is illuminated by white light. The agreement with theory is good over a wide range of Na densities and added N2 densities. GRA

N78-16360# Naval Surface Weapons Center, White Oak, Md.
SOLID REACTANTS FOR FLOURINE GAS GENERATOR Final Report
Ming G. Lai, Herman Cordova, I., Russel Bardos, and Daniel L. Love 1 Mar. 1977 38 p refs
(AD-A047290; NSWC/WOL/TR-77-23) Avail: NTIS HC A03/MF A01 CSCL 20/5

Pyrolysis of CoF3 results in the conversion of CoF3 to CoF2, releasing fluorine gas in the process. The kinetics of the pyrolysis is a function of temperature. The maximum fluorine yield was found to be about 67% of the theoretical value. Loss of fluorine is attributable to the reaction of fluorine with the surface of the reaction vessel at elevated temperature. Author (GRA)

N78-16361# Avco-Everett Research Lab., Everett, Mass.
OPTICAL CONVERSION PROCESSES Semiannual Report, 15 Mar. - 15 Sep. 1977
Daniel W. Trainor and S. A. Mani 15 Sep. 1977 69 p refs
(Contract N00014-76-C-1162)
(AD-A047214) Avail: NTIS HC A04/MF A01 CSCL 20/5

With the delivery and modification of an untuned high power KrF laser, experiments began on optical conversion to longer wavelengths with various candidates generated using scalable production techniques. For ease of demonstration of principle, the candidates hydrogen, iron and calcium were identified as compatible with the available power and bandwidth of our pump laser and were therefore first considered. These results demonstrate that efficient conversion of KrF towards longer wavelengths is achievable using an untuned laser as the pump. Also, the technique of producing refractory metals in densities sufficiently high for single pass amplified spontaneous emission by the decomposition of organometallic compounds is clearly established. GRA

N78-16362# Avco-Everett Research Lab., Everett, Mass.
OPTICAL CONVERSION PROCESSES Semiannual Report, 15 Sep. 1976 - 15 Mar. 1977
Daniel W. Trainor and S. A. Mani 15 Mar. 1977 33 p refs
(Contract N00014-76-C-1162)
(AD-A047213) Avail: NTIS HC A03/MF A01 CSCL 20/5

The overall goal of this experimental program is to identify scalable techniques that efficiently convert existing high power UV lasers to lasers operating at longer wavelengths in the visible. Two non-linear optical conversion techniques that we have

considered are: stimulated Raman and parametric conversion involving the KrF laser (248 nm). The objective of this contract is to suggest likely acceptor atoms for each technique which will thereby allow us to evaluate some of the key technical issues involved. These include: the production of receptor candidates in the gas phase (typically reRractory metals), the volumetric removal of the lower laser level in the stimulated Raman approach to prevent 'bottle necking' and allow recycling of the atoms during the laser pulse, and the consideration of overall system efficiency and scalability to high power.
Author (GRA)

N78-16363# Avco-Everett Research Lab., Everett, Mass.
INVESTIGATION OF ELECTRON IMPACT PROCESSES RELEVANT TO VISIBLE LASERS Semiannual Report, 1 Sep. 1976 - 28 Feb. 1977
M. John W. Boness and H. A. Hyman 28 Feb. 1977 45 p refs
(Contract N00014-75-C-0064)
(AD-A047216) Avail: NTIS HC A03/MF A01 CSCL 20/5

During this contract period the noise background in the electron spectrometer has been reduced to an acceptable level. Two parallel efforts are currently underway to investigate and optimize metastable rare gas atom production. A glow discharge source has been constructed which produces of the order 10 to the 8th power/cu.cm. argon metastable atoms within the collision volume intercepted by the electron beam. Electron scattering experiments are currently underway using this source. In addition the ion current capabilities of a Duoplasmatron ion source are being explored with a view to potential application to a charge transfer source of metastable rare gas atoms. The projected metastable density achievable from such a system should be of the order 10 to the 10th power/cu.cm. which represents two orders of magnitude improvement over the presently employed glow discharge source. Author (GRA)

N78-16364# Avco-Everett Research Lab., Everett, Mass.
INVESTIGATION OF ELECTRON IMPACT PROCESSES RELEVANT TO VISIBLE LASERS Semiannual Report, 1 Mar. - 31 Aug. 1976
M. John W. Boness and H. A. Hyman 31 Aug. 1976 33 p refs
(Contract N00014-75-C-0064)
(AD-A047215) Avail: NTIS HC A03/MF A01 CSCL 20/5

During this contract period construction of the electron spectrometer has been completed. The performance of the instrument has been appraised from measurements of energy loss spectra in argon and helium. Currently efforts are in progress to reduce the background signal in the instrument arising from the incident electron beam suffering inelastic collisions with various surfaces and eventually scattering into the analyzer optics.
Author (GRA)

N78-16365# California Univ., Livermore. Lawrence Livermore Lab.
THEORETICAL INTERPRETATION OF ANGLE-AND POLARIZATION DEPENDENT LASER LIGHT ABSORPTION MEASUREMENTS
J. J. Thomson, W. L. Kruer, A. B. Langdon, C. E. Max, and W. C. Mead 21 Jun. 1977 11 p refs Presented at the Anomalous Absorption Conf., Vancouver, British Columbia, Canada, 10 May 1977
(Contract W-7405-eng-48)
(UCRL-79628; Conf-770571-2) Avail: NTIS HC A02/MF A01

It was shown that recently published observations of angle- and polarization dependent absorption of intense laser light are consistent with computer simulations of resonance absorption in a steepened plasma profile, with the addition assumption of a modestly rippled critical surface. About 10 percent absorption seems to be due to mechanisms not addressed in the simulations. ERA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N78-16366 Massachusetts Univ., Amherst.
LUBRICATION OF A PLANE STRAIN DRAWING PROCESS BY A RIGID-PLASTIC SOLID Ph.D. Thesis
Kenneth Richard Halliday 1977 115 p
Avail: Univ. Microfilms Order No. 77-26423

Solid lubricants in metal forming processes are given, including a review of the current literature. Solution techniques for large deflection plasticity problems are discussed. An upper bound solution for the entrainment of rigid-plastic solid lubricant films is developed, and a semi-empirical equation relating the lubricant throughout to the die semi-angle, the ratio of the yield strengths of the lubricant and workpiece materials and the tractions due to friction at the die-film and film-workpiece surface are presented. The analysis is verified by means of plane strain drawing experiments on aluminum strips covered with paraffin wax and soap. The equation is shown to overestimate the throughput by a maximum of 20%. The throughput is shown to be independent of draw speed for speeds up to 0.14 m/s and directly proportional to the initial film thickness. Dissert. Abstr.

N78-16367 Michigan Univ., Ann Arbor.
A STUDY OF THE CHARACTERISTICS OF AUTOMOTIVE HYDRAULIC DAMPERS AT HIGH STROKING FREQUENCIES Ph.D. Thesis
Harold Harvey Lang 1977 254 p
Avail: Univ. Microfilms Order No. 77-26288

This dissertation is concerned with: (1) The determination of the characteristics of the damping forces generated by the operation of automotive type shock absorbers in the frequency range of 1 to 10 Hz and with amplitudes up to plus or minus two inches and (2) The development of a fundamental understanding of the phenomena that cause the dynamic behavior. Development of a mathematical model of shock absorber performance is used, based upon the dynamic pressure-flow characteristics of the shock absorber fluid and the dynamic action of the valves. This model is then programmed on an analog computer. In order to implement the computer model, certain operating parameters, such as dynamic discharge coefficients and valve operating forces were experimentally determined.
Dissert. Abstr.

N78-16368 Texas Technological Univ., Lubbock.
A MATHEMATICAL TREATMENT OF THE RADIAL TIRE MODELED AS A ROTATING CYLINDRICAL SHELL ON AN ELASTIC FOUNDATION Ph.D. Thesis
Tridib Kumar Roy 1977 182 p
Avail: Univ. Microfilms Order No. 77-25517

A mathematical model has been developed which adequately represents the static and dynamic behavior of a radial tire. The tire has been treated as a rotating cylindrical shell on an elastic foundation. The motion has been restricted to the plane of the tire only. The principle of minimum energy is employed to derive the equations of motion. Both free and forced vibration cases are discussed. An expression for the natural frequencies has been obtained. The applied force and the solutions for the radial and tangential deflections have been written in Fourier series expansion form. The Laplace transforms and convolution theorem are used for the analysis. Both steady-state and transient solutions for the deflections have been obtained. The condition of instability has been examined to determine the limiting speed at or above which staning wave phenomena occur. Dissert. Abstr.

N78-16369* National Aeronautics and Space Administration. Pasadena Office, Calif.
MOTION RESTRAINING DEVICE Patent
Allen G. Ford, inventor (to NASA) (JPL) Issued 13 Dec. 1977 8 p Filed 30 Apr. 1975 Supersedes N75-22748 (13 - 14, p 1659) Sponsored by NASA
(NASA-Case-NPO-13619-1; US-Patent-4,062,245; US-Patent-Appl-SN-572990; US-Patent-Class-74-81; US-Patent-Class-74-83; US-Patent-Class-185-38) Avail: US Patent Office CSCL 20K

A motion-restraining device for dissipating at a controlled rate the force of a moving body is discussed. The device is characterized by a drive shaft adapted to be driven in rotation by a moving body connected to a tape wound about a reel mounted on the drive shaft, and an elongated pitman link having one end pivotally connected to the crankshaft and the opposite end thereof connected with the mass through an energy dissipating linkage. A shuttle is disposed within a slot and guided by rectilinear motion between a pair of spaced impact surfaces. Reaction forces applied at impact of the shuttle with the impact surfaces include oppositely projected force components angularly related to the direction of the applied impact forces.

Official Gazette of the U. S. Patent Office

N78-16370*# National Aeronautics and Space Administration, Washington, D. C.

HYBRID PROPULSION SYSTEMS FOR MOTOR VEHICLES WITH PREDOMINANTLY INTERMITTENT MODES OF OPERATION

H. Bartsch, J. Helling, and H. Schreck Dec. 1977 14 p refs Transl. into ENGLISH from VDI-Z (West-Germany), v. 119, no. 3, Feb. 1977 p 141-146 Transl. by SCITRAN, Santa Barbara, Calif.

(Contract NASw-2791)

(NASA-TM-75189) Avail: NTIS HC A02/MF A01 CSCL 13F

A small delivery vehicle was equipped with a flywheel-hybrid drive and compared in test stand and driving tests with a conventional drive vehicle. It turned out that with the hybrid drive, energy can be saved and exhaust emissions can be reduced.

Author

N78-16371# Naval Postgraduate School, Monterey, Calif.

UNSTEADY EFFECTS ON THE MEASUREMENT OF TOTAL PRESSURE IN ROTATING MACHINES M.S. Thesis

Vernon James Larson Sep. 1977 76 p refs

(AD-A047234) Avail: NTIS HC A05/MF A01 CSCL 20/4

The pressure averaging of different pneumatic impact probes was investigated using a periodic flow generator in order to establish corrections for probe measurements made in a compressor, and to guide in the selection of probe geometries to be used in the compressor. The Kulite transducer probe used as a reference in these measurements was also used, with both continuous and synchronized sampling, to measure the flow from the compressor rotor. It was concluded that the corrections required to be made to the pneumatic impact pressure measurements were negligible at 50% design speed, but might be significant at higher speeds if the probe system volume were not properly sized.

Author (GRA)

N78-16372# Naval Postgraduate School, Monterey, Calif.

A STUDY OF PULL-THROUGH FAILURES OF MECHANICALLY FASTENED JOINTS M.S. Thesis

Robert N. Freedman Sep. 1977 81 p refs

(AD-A047142) Avail: NTIS HC A05/MF A01 CSCL 13/5

The relationship between the bending moment and the through-plane shear force in the vicinity of a mechanical fastener at failure was determined. Experiments were conducted on 4-inch wide flat plate aluminum and graphite-epoxy composite specimens that modeled portions of a wing skin along a spar and along a rib. The composite specimens were either 8-ply or 16-ply balanced layups and were simply supported at two opposing edges and free along the other two edges. The fasteners were pulled normal to the plates, and the maximum force at failure was measured for specimen lengths varying from two to six inches between supports. Two analyses were made; one for small elastic deflections of a thin orthotropic plate, and another for a beam in the elastic range. A mesh generator for a finite element model of the plate around the fastener was also developed for the computer program ADINA.

GRA

N78-16373# Sandia Labs., Albuquerque, N. Mex.

MEASUREMENT OF WAVE PROFILES IN SHOCK-LOADED SOLIDS

R. A. Graham 1977 33 p refs Presented at 6th AIRAPT Intern. High-pressure Conf., Boulder, Colo., 25 Jul. 1977

(Contract EY-76-C-04-0789)

(SAND-77-1056C; Conf-770706-15) Avail: NTIS HC A03/MF A01

The evolution of the numerous detectors which measure wave profiles in solids subjected to rapid impulsive loading was traced and principal trends were identified. Recent capabilities for the measurement of transverse or higher order motions (acceleration and velocity gradient) are described.

ERA

N78-16374# General Electric Co., St. Petersburg, Fla. Metallurgy and Ceramics Lab.

ELECTRON BEAM WELDING USING FUSION AND COLD WIRE FILL

F. F. Kuncz 27 May 1977 38 p

(Contract EY-76-C-04-0656)

(GEPP-297) Avail: NTIS HC A03/MF A01

A straight-fusion (self-filler) welding technique generally poses no problem for electron beam welding. However, where control of penetration is a critical item and burn through cannot be tolerated, this technique may not be satisfactory. To assure against beam spike burn through on a 1/4 inch deep weld joint, a low power root fusion pass, supplemented by numerous filler passes, was selected. However, this technique proved to have numerous problems. Voiding and porosity showed frequently in the first applications of this cold wire filler process. Taper out cratering, bead edge however, were overcome. Employment of a circle generator provided the necessary heating of the joint walls to eliminate voids. The moving beam spot also provided a stirring action, lessening porosity. Taper out catering was eliminated by adjusting the timing of the current cutoff and wire feed cutoff. Undercutting, bead height, and spatter were controlled by beam defocus.

ERA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N78-16375# National Bureau of Standards, Washington, D. C.

PROCEEDINGS OF THE MEETING OF THE MECHANICAL FAILURE PREVENTION GROUP 26TH

T. Robert Shives and William A. Willard Sep. 1977 299 p Conf. held at IIT Research Inst., Chicago, 17-19 May 1977 Sponsored in part by Office of Naval Research, Arlington, Va. FAA, Wash. D. C. NASA, Goddard

(PB-272848/3; NBS-SP-494) Avail: NTIS HC A13/MF A01 CSCL 14B

Nondestructive tests for the detection, diagnosis, and prognosis of mechanical failure are considered. Oil analysis, signature analysis, railroad system diagnostics, and land vehicle diagnostics are included.

GRA

N78-16376# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

ARRIVAL INSPECTIONS/PRE-OPERATIONAL INSPECTIONS (AVIATION MATERIEL) Final Report

Roy L. Miller 31 Aug. 1977 22 p refs Supersedes TOP-1-3-505

(AD-A047260; TOP-7-3-503; TOP-1-3-505 Avail: NTIS HC A02/MF A01 CSCL 01/3

A method is described for evaluation of test item completeness, conditions, and operability upon receipt for testing. This report identifies the facilities and equipment required. It provides procedures for documents, arrival, receiving, packaging, maintenance test package, item, inventory, safety, preoperational and technical inspections. This is applicable to aviation materiel.

Author (GRA)

N78-16377# Naval Research Lab., Washington, D. C.

A COMPARATIVE ACCURACY OF SEVERAL DISCRETE METHODS FOR LOWER CONFIDENCE LIMIT ON SYSTEM RELIABILITY M.S. Thesis

Hariono Sep. 1977 87 p refs

(AD-A047171) Avail: NTIS HC A05/MF A01 CSCL 14/4

This thesis is a comparative accuracy study of several discrete methods for lower confidence limits on series system reliability. Computer simulations were used to compare the accuracy of

the procedures. Five hundred replications were used in all simulations. Accuracy of each procedure was determined by computing appropriate percentile points of the distributions of the lower confidence limits. A randomization technique was used to improve the performance of one of the procedures. The systems simulated had reliabilities ranging from 0.720 to 0.950. They were composed of five, ten, thirteen, and fifteen components, and had component sample sizes of fifteen, thirty, fifty, and larger in the case of unequal sample sizes. Based on the simulation results the accuracy of the procedures were compared by common comparison with the true system reliabilities which were known in advance prior to the component tests. Author (GRA)

N78-16378# Science Applications, Inc., La Jolla, Calif.
ASSESSMENT OF THICK SECTION RADIOGRAPHY Final Report
D. E. Rundquist, D. A. Sargis, C. G. Cassapakis, and V. J. Orphan Jun. 1977 155 p refs
(EPRI Proj. 607-1)
(EPRI-NP-461) Avail: NTIS HC A08/MF A01

The basis of the realistic analytic model was the use of radiation transport codes to accurately simulate the proper scattered and direct beam that interacted with the imaging system. The mathematical description of the individual system components is described as a prelude to a description of the integrated system model. The emphasis is, however, on calculational results such as: fractional contribution to image from incident beam; effect of beam filters; buildup factors; collimation effects; backscatter effects; and thickness sensitivity. ERA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N78-16379 Fiat S.p.A., Turin (Italy).
ON LOW- AND HIGH-CYCLE FATIGUE RUPTURES AT THE SAME LOAD IN Ti-6Al-4V
G. Mannone, A. Bracco, and S. Tosto 23 Mar. 1976 21 p refs Repr. from Metallography, no. 10, 1977 p 315-335
(ICAF-974) Copyright. Avail: Issuing Activity

Bending fatigue strength curves were obtained for a commercial Ti-6Al-4V alloy measured at different temperatures, using notched and unnotched specimens with random and sinusoidal excitation. Sinusoidal fatigue tests show a gap at about one million cycles between short and long fatigue life, which is explained by brittle nucleation at low cycles originating at preexisting microcavities on the surface caused by removal of crystals. The results also show ductility at high cycles. The nucleation is always brittle with random excitation. In all cases, crack propagation is intergranular and takes place to a different extent in both brittle and ductile zones of the specimen. Author

N78-16380 Ohio State Univ., Columbus.
AN EVALUATION OF VISCOELASTIC RESPONSE TO OSCILLATORY SHEAR Ph.D. Thesis
Herbert Richard Lander, Jr. 1977 264 p
Avail: Univ. Microfilms Order No. 77-24656

Initial tests were carried out whereby the equilibrium viscous and elastic responses were characterized at four test temperatures. The kinetic rate portion of the Brodkey Kinetic Elastic Model, which was modified for the equilibrium case, adequately represented the basic shear diagram over six orders of magnitude. The rheogoniometer was suitable for characterizing the oscillatory responses of the viscoelastic test solution. The elastic parameters suggested by the theory were evaluated with regard to the effects of shear rate, oscillatory frequency and temperature. This behavior was found to be complex and intricately associated with the viscous responses or the same intramolecular phenomena which affects the viscous behavior of the polymer. From a kinetic viewpoint, the elastic behavior is associated with the structural parameter and tends to diminish as does viscosity with increased shear. Dissert. Abstr.

N78-16381 Ohio State Univ., Columbus.
THE INFLUENCE OF HOLE PROCESSING AND JOINT VARIABLES ON THE FATIGUE LIFE OF SHEAR JOINTS Ph.D. Thesis
Thomas Kittrell Moore 1977 294 p
Avail: Univ. Microfilms Order No. 77-24672

Numerous fatigue test specimens were cycled in constant amplitude fatigue with a peak gross area stress of 30.7 ksi and a R ratio of 0.1. The specimens were of four designs: zero, 5%, 50%, and 100% load transfer. Each specimen had two fasteners installed. The fasteners used were lokbolts and the cold working system, when used, was the solid sleeve cold working system. All data collected was recorded in computer files, and after cycling was completed, mulitple stepwise regression analysis was performed with specimen life (cycles to failure) as the dependent variable. A family of 15 models, predicting from 47 to 86% of the variation in specimen fatigue lives, was developed. Hole surface roughness was found generally either not to enter into the predictive equations, or to enter very weakly into the model. Dissert. Abstr.

N78-16382 Syracuse Univ., N. Y.
A FINITE ELEMENT STUDY ON CRACK TIP DEFORMATION Ph.D. Thesis
Wan-liang Hu 1976 67 p
Avail: Univ. Microfilms Order No. 77-24545

The moire crack tip strain measurements made on double-edge notched specimens loaded into the region of general yielding were compared with the results calculated by finite element method. It was found that the bulk of the strain measurements agreed well with the results of the plane stress calculations except in the small area close to the crack tip. The crack tip region was stiffened against plastic deformation by the triaxial state of stress. The region affected by the crack tip stiffening extends to a distance from the crack tip equal to the specimen thickness. This crack tip stiffened zone is embedded in the characteristic plane stress zone if the ratio of specimen thickness and the total net cross-sectional width is equal to or more than ten. Dissert. Abstr.

N78-16383 Syracuse Univ., N. Y.
EFFECTS OF ASPECT RATIO ON PARAMETRIC RESPONSE OF NONLINEAR RECTANGULAR PLATES - ANALYSIS AND EXPERIMENT Ph.D. Thesis
Germain Laurent Ostiguy 1976 421 p
Avail: Univ. Microfilms Order No. 77-24401

Analysis and experiments were carried out to determine the stability characteristics and the stationary and nonstationary parametric responses of simply-supported rectangular plates with various aspect ratios which are subjected to the action of periodic in-plane forces uniformly distributed along two opposite edges. The nonlinear large-deflection plate theory used in the analysis was derived in terms of the stress function F and lateral displacement w. In the analysis, particular attention was paid to satisfy the specific boundary conditions obtained in the experimental model so as to draw conclusions with sufficient degree of confidence. General rectangular plates were considered, the aspect of the plate being regarded as an additional parameter of the system. Dissert. Abstr.

N78-16384 Syracuse Univ., N. Y.
GENERAL INSTABILITY OF INFINITELY LONG TRAPEZOIDALLY CORRUGATED PLATES UNDER SHEAR Ph.D. Thesis
David Perel 1976 122 p
Avail: Univ. Microfilms Order No. 77-24571

The usual method of estimating buckling loads of a corrugated plate is to replace it by a supposedly equivalent orthotropic flat plate and then to make a standard flat plate buckling analysis. In order to assess the accuracy of this method, shear buckling loads were calculated for a class of trapezoidally corrugated plates that are infinitely long in the direction of the corrugations. This approach considers the trapezoidally corrugated plate as a nonplanar assemblage of flat plates and uses the principle of stationary total potential energy. Results show that orthotropic plate theory can greatly underestimate the buckling strength in the case of narrow plates. The error diminishes as the number

of corrugations increases but is still significant for plates that are five or more corrugations wide. Dissert. Abstr.

N78-16385 Stanford Univ., Calif.
ON INITIAL BUCKLING AND RESIDUAL STRENGTH OF IMPERFECT CIRCULAR CYLINDRICAL SHELLS UNDER AXIAL COMPRESSION Ph.D. Thesis
John Franklin Jones, Jr. 1977 140 p
Avail: Univ. Microfilms Order No. 77-25687

The bending, buckling, and postbuckling of initially imperfect, thin circular cylindrical shells in axial compression were investigated primarily at loads below 50% of the classical buckling load. A solution based on the Reissner variational principle in conjunction with the von Karman-Donnell strain-displacement relations, the direct variational approach, and a convenient deformation theory of plasticity was obtained and examined. The solution incorporates stress and displacement distribution capable of representing the modified chessboard pattern of initial buckling and approaching those of the Yoshimura pattern corresponding to the fully developed postbuckling process. Dissert. Abstr.

N78-16386 Washington Univ., Seattle.
PARAMETRIC EXCITATION OF A CLAMPED BEAM Ph.D. Thesis
Karlheinz Eisinger 1977 235 p
Avail: Univ. Microfilms Order No. 77-26821

The occurrence of parametric amplification of the lateral vibratory motion of dynamically end loaded beams is discussed. Primary attention is given to a clamped-clamped, uniform, slender beam with a lumped mass at its center. The theoretical development of this analysis includes the derivation of the equations of motion in form of three nonlinear, coupled wave equations. Based on the restriction to slender beams and small amplitude motion, it is shown that the systems dynamic characteristic may be described approximately by a forced, damped Mathieu equation. There exists a close relationship between the end load amplitude and frequency and the Mathieu equation parameters. The limiting criteria for the occurrence of the amplification phenomenon is shown to be a factor of the frequency of the beam support input motion. Dissert. Abstr.

N78-16387* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TV FATIGUE CRACK MONITORING SYSTEM Patent
Reginald J. Exton, inventor (to NASA) Issued 13 Dec. 1977 5 p Filed 20 Jul. 1976 Supersedes N76-28530 (14 - 19, p 2462)
(NASA-Case-LAR-11490-1; US-Patent-4,063,282; US-Patent-Appl-SN-707125; US-Patent-Class-358-106) Avail: US Patent Office CSCL 20K

An apparatus is disclosed for monitoring the development and growth of fatigue cracks in a test specimen subjected to a pulsating tensile load. A plurality of television cameras photograph a test specimen which is illuminated at the point of maximum tensile stress. The television cameras have a modified vidicon tube which has an increased persistence time thereby eliminating flicker in the displayed images. Author

N78-16388*# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mechanical Engineering.
ELASTO-PLASTIC FLOW IN CRACKED BODIES USING A NEW FINITE ELEMENT MODEL Ph.D. Thesis
Michael E. Karabin, Jr. Nov. 1977 189 p refs
(Grant NGR-39-087-053)
(NASA-CR-155522; SM-77-11) Avail: NTIS HC A09/MF A01 CSCL 20K

Cracked geometries were studied by finite element techniques with the aid of a new special element embedded at the crack tip. This model seeked to accurately represent the singular stresses and strains associated with the elasto-plastic flow process. The present model was not restricted to a material type and did not predetermine a singularity. Rather the singularity was treated as an unknown. For each step of the incremental process the nodal degrees of freedom and the unknown singularity were found through minimization of an energy-like functional. The singularity and nodal degrees of freedom were determined by means of an iterative process. Author

N78-16389*# National Aeronautics and Space Administration, Washington, D. C.
DYNAMICAL THEORY OF STABILITY FOR ELASTIC RODS WITH NONLINEAR CURVATURE AND TWIST
J. Wauer Dec. 1977 14 p refs Transl. into ENGLISH from Ingr.-Arch. (West-Germany), v. 46, 1977 p 161-168 Translation was announced as A77-40345 Transl. by SCITRAN, Santa Barbara, Calif.
(Contract NASw-2791)
(NASA-TM-75166) Avail: NTIS HC A02/MF A01 CSCL 20K

Considering non-linear terms in the curvature as well as in the twist, the governing boundary value problem for lateral bending of elastic, transverse loaded rods is formulated by means of Hamilton's principle. Using the method of small vibrations, the associated linearized equations of stability are derived, which complete the currently accepted relations. The example of the simplest lateral bending problem illustrates the improved effect of the proposed equations. Author

N78-16390# Association Aeronautique et Astronautique de France, Paris.
RELIABILITY ANALYSIS OF FATIGUE-STRESSED STRUCTURES ON THE BASIS OF TEST RESULTS UTILISATION. PART 1: RELIABILITY AND FATIGUE BASES. PART 2: DIFFICULTIES IN APPLYING MATHEMATICAL RELIABILITY
William Barrois (L'Armement (Air), Vanves, France) 1977 43 p refs Repr. from Aeronaut. Astronaut. (Paris), no. 66, Oct. 1977 p 51-75, and no. 67, Dec. 1977 p 39-56 In FRENCH; ENGLISH and GERMAN summaries
(ICAF-982) Avail: NTIS HC A03/MF A01

The principles of mathematical reliability and fundamental data concerning the behavior of notched samples and structures under fatigue stress are reviewed. The data needed for forecasting the fatigue possibilities of structures is defined and the data obtained on the mean endurance of notched samples and structures and on the dispersion of durability are reviewed. To reduce the local processes in the structure to the known behavior of laboratory tested notched samples, the theoretical stress at the notch root and the depthwise computed stress gradient are compared. Author

N78-16391# National Aeronautical Establishment, Ottawa (Ontario).
THE DISSECTION OF AN AIRCRAFT LOADS SPECTRUM PRODUCED BY PEAK-COUNTING ACCELEROMETERS
A. V. Rugienius 16 Nov. 1977 24 p refs
(LTR-ST-951; ICAF-978) Avail: NTIS HC A02/MF A01

Wing fatigue damage to aircraft was examined in regard to measurements made by peak-counting accelerometers. Major causes of damage were defined as repetitive stresses caused by ground loads, air loads and the ground-air-ground cycle. These phases of the aircraft loads environment were discussed in detail. Recommendations were made on the procedure for converting accelerometer data into loads spectra. B.L.P.

N78-16392# National Aeronautical Establishment, Ottawa (Ontario).
MODIFICATIONS TO FALSTAFF THAT WERE REQUIRED FOR OPERATION ON A 16 K PDP-8e MINICOMPUTER
Rolf Hangartner 15 Feb. 1977 19 p refs
(LTR-ST-899; ICAF-977) Avail: NTIS HC A02/MF A01

The FALSTAFF (fighter aircraft loading standard for fatigue evaluation) is a computer program that utilizes a Markov chain method to generate a simulation of a service load history for a typical fighter aircraft. This service load history consisted of 200 flights of varying length and severity and was characterized by some 36,000 values in a sequence of maximum and minimum loads. The sequence of loads was generated from a set of matrices representing the bivariate distributions of load for three characteristic flight missions and from other statistical data concerning flight duration, aircraft configuration, and ground loads by means of a computer program written in FORTRAN. This program may be adapted to output the load sequence in a form appropriate to a particular fatigue testing system, i.e. punched tape, magnetic tape, or direct machine output. Author

N78-16393# Politecnico di Torino (Italy). Istituto di Scienza delle Costruzioni.

QUICK METHODS FOR THE STUDY OF FATIGUE IN STEELS

Ugo Rossetti, Giuseppe Mancini, and Jose Juan Martini (Univ. Nacl. de Cordoba, Argentina) Nov. 1974 45 p refs Sponsored by OECD

(ICAF-973) Avail: NTIS HC A03/MF A01

An extensive international research on the quick methods for the study of fatigue in steels, was carried out. The results are analyzed according to the Locati and Prot methods. The effects of the operative variables are evidenced and some conclusions are drawn on the reliability of the procedures used in the interpretation of the results. Author

N78-16394# Aeronautical Research Labs., Melbourne (Australia).

EXPERIMENTS ON CARBON FIBRE REINFORCED PLASTIC TUBES IN TORSION

Robin Ellis and Brian C. Hoskin 1977 51 p refs

(ARL/Struc-Rept-364; AR-000-728) Copyright. Avail: NTIS HC A04/MF A01

An experimental program was carried out on the torsional properties of carbon fiber reinforced plastic tubes. Two laminate patterns were investigated: the first had equal numbers of layers with fibers at + 45 deg and - 45 deg, whilst the second had equal numbers of layers with the fibers + 30 deg, - 30 deg and 90 deg, all angles being measured with respect to a longitudinal generator of a tube. The tubes had various wall thickness, the thinner ones being designed to fail by torsional buckling and the thicker ones to undergo a material strength failure. For the buckling failures, a significant difference was observed between the critical values of the torque for clockwise and anti-clockwise loadings: this difference was related to the fiber directions in the outer layer. Author

N78-16395# California Univ., Berkeley. Dept. of Mechanical Engineering.

SHELL THEORY FROM THE STANDPOINT OF FINITE ELASTICITY

P. M. Naghdi Sep. 1977 15 p refs

(Contract N00014-75-C-0148)

(AD-A047095; UCB/AM-77-7) Avail: NTIS HC A02/MF A01 CSCL 20/11

This is an account of the nonlinear theory of thin shells from the standpoint of finite elasticity, together with a brief summary of some related recent researches on the subject. The development of the basic theory, as well as a discussion of constitutive equations for elastic shells, are presented via a direct approach on the basis of a continuum model known as a Cosserat surface rather than from the three-dimensional equations of nonlinear elasticity. Author (GRA)

N78-16396# State Univ. of New York, Buffalo. Dept. of Engineering Science, Aerospace Engineering and Nuclear Engineering.

INTERFACIAL ELASTIC PARAMETERS IN TORSIONAL VIBRATIONS OF A PERIODIC STRUCTURED CYLINDRICAL ROD

Richard P. Shaw and R. K. Kaul Sep. 1977 18 p refs

(Contract N00014-75-C-0302)

(AD-A047030; Rept-108) Avail: NTIS HC A02/MF A01 CSCL 20/11

In this note, we develop a method for qualitatively sketching the frequency spectrum of torsional waves propagating in a solid cylinder with periodic structure. The method depends upon the use of interfacial elastic parameter, which simplifies the problem considerably. Author (GRA)

N78-16397# State Univ. of New York, Buffalo. Dept. of Engineering Science, Aerospace Engineering and Nuclear Engineering.

FREE LATERAL VIBRATION OF AN AXIALLY CREEPING BEAM-COLUMN UNDER INITIAL AXIAL COMPRESSION

F. A. Cozzarelli and G. Tittemore Sep. 1977 23 p refs

(Contract N00014-75-C-0302)

(AD-A047029; Rept-98) Avail: NTIS HC A02/MF A01 CSCL 20/11

The free lateral vibration of a nonlinear viscoelastic beam-column subjected to an initial compressive axial load is considered. The constitutive law is formulated with a linear elastic term and with power functions of stress in the transient and steady creep terms, and is of the nonlinear generalized Kelvin type. By assuming that the stress caused by the oscillation is of much smaller magnitude than the initial stress, the problem is linearized. The problem is analyzed for five special viscoelastic models using small deformation theory, and numerical results are discussed for a stainless steel alloy. Author (GRA)

N78-16398# Naval Research Lab., Washington, D. C.

AN INVESTIGATION OF METHODS FOR DETERMINING NOTCH ROOT STRESS FROM FAR FIELD STRAIN IN NOTCHED FLAT PLATES M.S. Thesis

John Charles Garske Sep. 1977 100 p refs

(AD-A047264) Avail: NTIS HC A05/MF A01 CSCL 20/11

Notched flat plate specimens have been tested to examine Neuber's equation and other relations with respect to their application in the determination of stresses in the plastic range at the notch root when the far field strain is known. A nonlinear finite element solution has also been obtained for notched flat plates in plane stress to facilitate an evaluation of it as an analytical method for calculating the behavior of stresses at the notch root. Experimental results indicate that Neuber's equation is ten to twenty-five percent in error for the notch geometry, strain level and material behavior encountered in the present study. Finite element analysis results were in close agreement with experimental results. Author (GRA)

N78-16399# Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.

STRUCTURAL INELASTICITY. 18: A SLIP MODEL FOR FINITE ELEMENT PLASTICITY Ph.D. Thesis

Hendrik VanRij and Philip G. Hodge, Jr. Sep. 1977 27 p refs

(Contract N00014-75-C-0177)

(AD-A047079; AEM-H1-18) Avail: NTIS HC A03/MF A01 CSCL 20/11

Conventional finite-element models are based on displacement or velocity fields which are at least continuous. However, it is known that perfectly plastic materials may exhibit discontinuities of the tangential velocity component along certain lines. In this investigation, a two-dimensional finite element model is proposed which will allow for such discontinuities. A regular pattern of triangular elements is assumed. The elements are assumed to be rigid and across the line separating any two adjoining elements. The normal displacement component is continuous, but a discontinuity may exist in the tangential component. The defining equations--compatibility, equilibrium and constitutive--are developed with the aid of the Principle of Virtual Work. Prandtl's punch problem is solved under plane strain conditions. Comparison is made with existing analytical and other numerical solutions, in order to evaluate the merits of allowing for discontinuities. Author (GRA)

N78-16400# Syracuse Univ., N. Y. Dept. of Mechanical and Aerospace Engineering.

SHEAR BUCKLING OF CORRUGATED PLATES WITH QUASI-SINUSOIDAL CORRUGATIONS

M. Iqbal Hussain and Charles Libove Jul. 1977 115 p refs

(PB-272894/7; MAE-5293-T4) Avail: NTIS HC A06/MF A01 CSCL 20K

The corrugated plate is regarded as a shell and its buckling load determined by the method of stationary total potential energy. On the basis of this approach, numerical buckling load data are obtained for simply supported curvilinearly corrugated plates covering a wide range of geometries. The results are compared with the predictions of orthotropic plate theory, and it is seen that the latter generally underestimates the buckling strength by a significant amount. GRA

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N78-16401* + National Aeronautics and Space Administration, Washington, D. C.
EARTH RESOURCES: A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 13
Apr. 1977 128 p
(NASA-SP-7041(13)) Avail: NTIS HC E05 CSCL 05B

This bibliography lists 524 reports, articles, and other documents introduced into the NASA scientific and technical information system between January 1977 and March 1977. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis. Author

N78-16402 George Washington Univ., Washington, D. C.
LITHOLOGY MAPPING OF CRYSTALLINE SHIELD TEST SITES IN WESTERN SAUDI ARABIA USING COMPUTER-MANIPULATED MULTISPECTRAL SATELLITE DATA Ph.D. Thesis
Herbert William Blodget 1977 223 p
Avail: Univ. Microfilm Order No. 77-23810

Two areas were selected in the Arabian Shield to provide ideal test sites for the evaluation of satellite remote sensing capabilities for geological mapping; emphasis was placed on rock discrimination using LANDSAT multispectral scanner data. The Sahl al Matran area of northwestern Saudi Arabia was selected as the primary test site for evaluating a wide range of optical-electrical (analog) and computer (digital) classification and enhancement techniques. Two interactive, digital, multispectral classification systems were tested that respectively employed the Bayesian maximum-likelihood and parallelepiped classification algorithms. A variety of computer enhancement techniques were evaluated. Dissert. Abstr.

N78-16403 Nevada Univ., Reno.
MODELING AND ANALYSIS OF HYDRAULIC INTERCHANGE OF SURFACE AND GROUND WATER Ph.D. Thesis
Alfred Benjamin Cunningham 1977 187 p
Avail: Univ. Microfilms Order No. 77-25079

A technique for modeling the hydraulic interchange between surface and ground water in an unconfined aquifer-river system was developed. Model predictive uncertainty consisted of statistical comparison of model output with field observations. Results indicated generally good overall predictive capability and included fair to good prediction of extreme high and low river stage and ground water table elevations. A procedure for quantifying uniqueness of model solution was developed. Uniqueness of solution investigation provided insight into the reliability associated with extrapolation of model results beyond the limits of observed field measurements. The model was utilized to delineate interrelationships among individual hydrologic system components as well as to determine the degree of influence of various parameters on system behavior. Dissert. Abstr.

N78-16404 Texas Univ., Austin.
COMPUTER DETECTION OF CITRUS INFESTATIONS USING AERIAL COLOR INFRARED TRANSPARENCIES Ph.D. Thesis
David Henry Williams 1977 173 p
Avail: Univ. Microfilms Order No. 77-23045

A computer algorithm is described which utilizes digitized color information from aerial color infrared transparencies to detect the presence of citrus mealybug (Pseudococcus citri Risso), brown soft scale (Coccus hesperidum L.), and Rio Grande gummosis in individual citrus trees. The color at each spatial point and color differences at adjacent points are used to locate the trees and to detect the infestations which are manifested by distinct color characteristics. The algorithm consists of four steps: a coordinate transformation to reduce the data base by one-third while simultaneously maximizing the class separation of the trees and background location of the individual trees, preprocessing for classification and classification of the individual trees according to health or infestation. Dissert. Abstr.

N78-16405 Oregon State Univ., Corvallis.
REMOTE SENSING APPLICATIONS IN HYDRO-GEOTHERMAL EXPLORATION OF THE NORTHERN BASIN AND RANGE PROVINCE Ph.D. Thesis
Thomas William Holder 1977 235 p
Avail: Univ. Microfilms Order No. 77-29413

An evaluation was conducted utilizing side-looking-airborne-radar (SLAR) and thermal infrared (TIR) detectors in a complementary fashion. The program consisted of preliminary overflights of SLAR for the detection of fault lineaments along which surface expressions of hydro-geothermal activity are localized. Interpretation of the SLAR imagery was used to generate TIR flightlines corresponding to the major lineaments. Subsequent flights incorporated TIR line scanners utilizing the mercury-cadmium-telluride, indium antimonide, and indium arsenide detectors. A map was produced depicting the interpreted data. The map graphically portrays the structural relationship between the interpreted surface hydro-geothermal sites and the fracture traces, at a scale of 1:500,000. Dissert. Abstr.

N78-16406 Kansas Univ., Lawrence.
RESERVOIR WATER QUALITY MONITORING WITH ORBITAL REMOTE SENSORS Ph.D. Thesis
James Raymond McCauley 1977 111 p
Avail: Univ. Microfilms Order No. 77-28892

Remotely sensed data acquired by the LANDSAT and Skylab satellites over major reservoirs in Kansas were studied to determine the feasibility of monitoring fresh water resources by satellite. The Tuttle Creek and Perry reservoirs were studied to determine the properties of reservoirs which control the spectral intensity of reflected sunlight as detected by the sensors. Water samples were collected from these two lakes concurrent with satellite overpass and were analyzed to determine the amount of suspended solids, chlorophyll content, and concentrations of phosphate, nitrate, and potassium ions, as well as water temperature and turbidity. Images in four spectral bands were regularly received for each satellite overpass. Computer compatible tapes were obtained retrospectively for most of the usable passes over the lakes. These have been processed and the output analyzed to determine the bands which best reflect water quality parameters measured. Dissert. Abstr.

N78-16407*# Environmental Research and Technology, Inc., Concord, Mass.
INVESTIGATION OF THE APPLICATION OF HCMM THERMAL DATA TO SNOW HYDROLOGY Progress Report, Oct. - Dec. 1977
James C. Barnes, Principal Investigator 10 Jan. 1978 5 p
Sponsored by NASA ERTS
(E78-10051; NASA-CR-155510) Avail: NTIS HC A02/MF A01 CSCL 08L

There are no author-identified significant results in this report.

N78-16408*# National Aeronautics and Space Administration, Washington, D. C.
APPLICATION OF LANDSAT IMAGES TO THE STUDY OF LEVEL SOILS FOR RECOGNIZING DRAINAGE AREAS Thesis Paper

Moises Urena Espinoza Dec. 1977 221 p refs Transl. into ENGLISH from "Aplicacion de Imagenes Lansat en Estudios de Suelos Nivel de Reconocimiento Area Desaguadero" (Bolivia), Thesis, 1977 p 1-206 Original Doc. Prep. by Universidad Boliviana Mayor de "San Simon", Facultad de Ciencias Agricolas y Pecuarias "Martin Cardenas", Cochabamba
(NASA-TM-75060) Avail: NTIS HC A10/MF A01 CSCL 08B

Photographic images from LANDSAT 1 were applied to the study of soil in Desaguadero, Bolivia, in order to locate areas with high agricultural and livestock potential. Photointerpretation techniques were emphasized and advantages of information obtained via multispectral satellite images in various bands and combinations were demonstrated. B.L.P.

N78-16409*# National Aeronautics and Space Administration, Washington, D. C.
RESULTS OF ANALYSIS OF FLIGHT AND GROUND OBSERVATION MATERIALS FOR FIRST YEAR OF FIRST STAGE OF "PROGRAM OF EXPERIMENTAL RESEARCH TO DEVELOP METHODS FOR REMOTE SOUNDING OF SOILS AND VEGETATION ON ANALOGOUS SECTIONS OF THE UNITED STATES AND USSR FOR 1975-1980"
Jan. 1978 133 p Transl. into ENGLISH from Rezultaty Analiza Materialov Samoletnykh i Nazemnykh Nablyudeniy I-Ogo Goda Pervogo Etapa 'Programmy Eksperimental Nykh Issledovaniy po Razrabotke Metodov Distantsionnogo Zondirovaniya Pochv i Rastitelnosti na Uchastkakhanalogakh v SShA i SSSR na 1975-1980 gg (Moscow), Rept. Academy of Sciences USSR, Jul. 1977 p 1-128 Transl. by SCITRAN, Santa Barbara, Calif. Original Doc. Prep. by Academy of Sciences USSR
(Contract NASw-2791)
(NASA-TM-75082) Avail: NTIS HC A07/MF A01 CSCL 08M

A joint U.S.S.R. and United States program to develop methods for remote sounding of soils and vegetation is reported. The program is being conducted on similar sections of land in the USSR and the United States. Details of the data obtained and the type of sensing equipments employed are provided in the appendices. Author

N78-16410*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE USE OF SNOWCOVERED AREA IN RUNOFF FORECASTS
Albert Rango, Jack F. Hannaford, Roderick L. Hall, Michael Rosenzweig, and A. Jean Brown Mar. 1977 33 p refs
(NASA-TM-78083; X-913-77-48) Avail: NTIS HC A03/MF A01 CSCL 08L

Long-term snowcovered area data from aircraft and satellite observations have proven useful in reducing seasonal runoff forecast error on the Kern river watershed. Similar use of snowcovered area on the Kings river watershed produced results that were about equivalent to methods based solely on conventional data. Snowcovered area will be most effective in reducing forecast procedural error on watersheds with: (1) a substantial amount of area within a limited elevation range; (2) an erratic precipitation and/or snowpack accumulation pattern not strongly related to elevation; and (3) poor coverage by precipitation stations or snow courses restricting adequate indexing of water supply conditions. When satellite data acquisition and delivery problems are resolved, the derived snowcover information should provide a means for enhancing operational streamflow forecasts for areas that depend primarily on snowmelt for their water supply.
Author

N78-16411*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
NASA/COUSTEAU OCEAN BATHYMETRY EXPERIMENT: REMOTE BATHYMETRY USING HIGH GRAIN LANDSAT DATA Final Report, Aug. 1975 - Apr. 1976
Fabian C. Polcyn Jul. 1976 131 p refs
(Contract NAS5-22597)
(NASA-CR-156658; ERIM-118500-1-F) Avail: NTIS HC A07/MF A01 CSCL 08J

Satellite remote bathymetry was successfully verified to 22 m depths where water clarity was defined by alpha = .058 m to the -1 power and bottom reflection, was 26% High grain Band 4 and Band 5 CCT data from LANDSAT 1 was used for a test site in the Bahama Islands and near Florida. The LORAN-C position information was used when the ships were underway making depth transects. Results are expected to be useful for updating charts showing shoals hazardous to navigation or in monitoring changes in nearshore topography.
Author

N78-16412*# ECON, Inc., Princeton, N. J.
ECON'S OPTIMAL DECISION MODEL OF WHEAT PRODUCTION AND DISTRIBUTION-DOCUMENTATION Final Report
15 Dec. 1977 60 p
(Contract NASw-3047)
(NASA-CR-155573; Rept-77-264-1) Avail: NTIS HC A04/MF A01 CSCL 02C

The report documents the computer programs written to implement the ECON optical decision model. The programs were written in APL, an extremely compact and powerful language particularly well suited to this model, which makes extensive use of matrix manipulations. The algorithms used are presented and listings of and descriptive information on the APL programs used are given. Possible changes in input data are also given.
Author

N78-16413# Shriver (R.) Associates, Parsippany, N. J.
US OIL AND NATURAL GAS FINDINGS COSTS. A STUDY FOR THE FEDERAL ENERGY ADMINISTRATION, VOLUME 1
Jul. 1977 172 p
(Contract FEA-CR-05-60731-00)
(PB-27400019; FEA/G-77/356-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 08I

Costs for historical U.S. oil and gas exploration efforts are presented and the level of such costs in 1980, 1985 and 1990 is projected. Data was developed for 17 onshore and 2 offshore regions in the Continental U.S. where the petroleum industry has traditionally focused its operations. In addition, 2 onshore and 2 offshore sectors of Alaska as well as the offshore Atlantic Coast region were also examined. Research is presented in terms of total dollar costs per foot drilled for oil and gas wells in 6 separate categories in each region. GRA

N78-16414# Shriver (R.) Associates, Parsippany, N. J.
US OIL AND NATURAL GAS FINDINGS COSTS. A STUDY FOR THE FEDERAL ENERGY ADMINISTRATION. VOLUME 2: STATISTICAL APPENDIX
1977 330 p
(Contract FEA-CR-05-60731-00)
(PB-274001/7; FEA/G-77/357-Vol-2-App) Avail: NTIS HC A15/MF A01 CSCL 08I

Total finding costs per foot statistics are provided from 1961 through 1974 for historical regions. Exploratory drilling cost per foot statistics from 1961 through 1974 are also presented, along with projections for 1980, 1985 and 1990. Geological and geophysical costs, lease rental and bonus costs and historical surface costs are summarized. GRA

N78-16415# Iowa Inst. of Hydraulic Research, Iowa City.
STOCHASTIC TRADE-OFFS FOR RESERVOIR OPERATION
Thomas E. Croley, II and K. N. RajaRao Jan. 1977 163 p refs
(Contract DI-14-34-0001-6016; OWET Proj. A-054-IA)
(PB-272630/5; IIHR-197) Avail: NTIS HC A08/MF A01 CSCL 13B

The stochastic trade-off methodology was developed to enable the estimation of risks or probabilities associated with achievement of various levels of a reservoir operation objective while maintaining minimum levels of another operation objective. Trade-offs were constructed by maximizing benefits with respect to one objective with the constraint that minimum levels of benefits must also be realized with respect to another objective. By repeating the optimization for many constraint levels; the trade-off function between objectives was constructed. The evaluation of the risks or probabilities proceeded through repeated objective trade-off determinations on an operational hydrology basis. GRA

N78-16416# Rutgers - The State Univ., New Brunswick, N. J. Water Resources Research Inst.
LAND AND RECREATIONAL DEVELOPMENT AT NEW JERSEY RESERVOIRS Completion Report
Stephen J. Souza and Patricia A. Perry Jul. 1977 25 p refs (PB-272636/2; W77-12257; OWRT-A-043-NJ-4) Avail: NTIS HC A02/MF A01 CSCL 13B

The rapid residential and urban growth which has occurred around major impoundments in the suburban portions of New Jersey, especially Lake Hopatcong, is illustrated and further development in the future is projected. Current housing trends indicate increasing percentages of small lot single family homes and of multiple family housing. The proposed Six Mile Run Reservoir was chosen for further study, exemplifying a planned reservoir in a rapidly urbanizing area. Phosphorus loadings were computed from storm and low flow data, and found to check closely with computed loads under present conditions. Estimates were made of projected future loadings under two alternative zoning plans. GRA

N78-16417# National Water Well Association, Worthington, Ohio.
PROCEEDINGS OF THE (3RD) NATIONAL GROUND WATER QUALITY SYMPOSIUM Final Report, 31 Mar. 1976 - 31 Jan. 1977
Jan. 1977 239 p Symp. held at Las Vegas, Nev., 15 - 17 Sep. 1976
(Contract EPA-68-03-2396)
(PB-272908/5; EPA-600/9-77-014) Avail: NTIS HC A11/MF A01 CSCL 13B

Proceedings included eight main sessions encompassing twenty-four technical papers. These were concerned with the disposal of waste on the land, the movement of pollutants in the subsurface, and artificial recharge. A special session was dedicated to ground water in the Las Vegas Valley. GRA

N78-16418# Princeton Univ. Observatory, N. J.
APPLICATION OF A FABRY-PEROT INTERFEROMETRY TO REMOTE SENSING OF GASEOUS POLLUTANTS Final Report, Aug. 1971 - Mar. 1975
W. Hayden Smith and Robert A. King Aug. 1977 144 p
(Contract EPA-68-02-0327; Grant EPA-R-800805)
(PB-273101/6; EPA-600/2-77-154) Avail: NTIS HC A07/MF A01 CSCL 14B

A method for the remote sensing of molecular species via the rotational Raman effect was developed. The method uses the properties of a scanning Fabry-Perot interferometer to multiplex the spectra in a manner specific for a given species. Furthermore, the method allows the 'in principle' sensitivity of remote pollutants to be increased by as much as 10,000 over the vibrational Raman effect. To achieve this goal, a scheme was developed for the rejection of the Raman spectra of the abundant background gases, N2 and O2. This was accomplished efficiently and with little loss of the Raman scattered light from the pollutant species. GRA

N78-16419# Bureau of Mines, Amarillo, Tex. Helium Operations.
ANALYSES OF NATURAL GASES, 1976 Annual Report, Information Circular 1977
B. J. Moore 1977 99 p refs Sponsored by Dept. of Interior (PB-272735/2; BM-IC-8749) Avail: NTIS HC A05/MF A01 CSCL 08I

Analyses and related source data are presented for 252 natural gas samples from wells and pipelines in 17 states. All samples were obtained and analyzed during calendar year 1976 as a part of Bureau of Mines investigations of the occurrences of helium in natural gases of countries with free market economies. GRA

N78-16420# Office of Technology Assessment, Washington, D. C.
ENGINEERING IMPLICATIONS OF CHRONIC MATERIALS SCARCITY: PROCEEDINGS OF A 4TH BIENNIAL ENGINEERING FOUNDATION CONFERENCE ON NATIONAL MATERIAL POLICY
Apr. 1977 330 p refs Conf. held at Henniker, N. H., 8-13 Aug. 1976 Prepared in cooperation with Federation of Mater. Soc., Washington, D. C. and Natl. Commission on Supplies and Shortages, Washington, D. C.
(PB-273193/3; OTA-M-44; LC-77-600014) Avail: NTIS HC A15/MF A01 CSCL 08I

This series of conferences on materials-related problems was designed to achieve four goals: to bring issues relating to materials before decision makers and the public, to sustain progress towards developing a national materials policy, to build a consensus as to the essential elements that should comprise a national materials policy, and to convey to decision makers in Congress and the executive branch of the federal government a perception of that emerging consensus. This consists of the papers presented, task force deliberations and findings, plenary discussions, and a sense of the meeting of the fourth Henniker Conference. Participants in the conference included representatives from business corporations, academic institutions, private research laboratories, and government agencies. GRA

N78-16421# Economic Research Service, Washington, D. C. Natural Resource Economic Div.
A SYSTEMS ANALYSIS APPROACH TO LAND USE PLANNING: AN EXPERIMENT IN INTERDISCIPLINARY EDUCATION
Reuben N. Weisz Sep. 1977 286 p refs
(PB-274114/8; AGERS-44) Avail: NTIS HC A13/MF A01 CSCL 13B

An experiment in the development and evaluation of systems analysis techniques for planning land use development on the rural urban fringe of Tucson, Arizona is presented. Five planning techniques were investigated: computer overlay mapping; professional judgment; linear programming model; a community development, financial feasibility model; and a land use game. The capabilities and limitations of both the analytic techniques and the land use planning models seminar are discussed. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N78-16422 Utah Univ., Salt Lake City.
TWO-STAGE COAL GASIFICATION TO HIGH-BTU GAS Ph.D. Thesis
Ying-Hsiao Li 1977 183 p
Avail: Univ. Microfilms Order No. 77-25073

A coal gasification process to produce a substitute for natural gas from coal without changing the form of carbon from coal to methane was developed. The catalyzed process is a two step operation. In the hydrosolvation stage, Hiawatha coal and the catalyst were slurred in tetralin under hydrogen pressure in a batch stirred tank reactor. A conversion of 85 percent was obtained using sulfided nickel-molybdenum, supported on alumina as a catalyst. The hydrogasification stage was conducted in the flow system of a fixed catalyst bed. The overall process indicated that the coal was converted to 62 percent gas, 10 percent gasoline, 7 percent middle oil, 2 percent heavy oil, 19 percent char. The yield of methane was 77 weight percent of the total gas and the heating value was 1202 BTU per standard cubic foot. Dissert. Abstr.

N78-16423 Drexel Univ., Philadelphia, Pa.
AN ANALYSIS OF ALTERNATIVE RESIDENTIAL HEATING SYSTEMS IN TERMS OF THREE CRITERIA: ENERGY CONSERVATION, ENVIRONMENTAL IMPACT AND LIFE-CYCLE ECONOMICS Ph.D. Thesis
Mark Joseph Wallin 1977 293 p
Avail: Univ. Microfilms Order No. 77-22537

The performance of a number of heating systems are

analyzed by dynamic computer simulations. The simulations make use of weather tapes with hourly data for the Delaware Valley region during the severe winter of 1963-64. The performance of the alternative heating systems are simulated by making use of a modular program. Environmental impact indices are assigned to each heating system in five categories: air pollution, water pollution, solid waste, land use and occupational safety and health. A life cycle economic analysis is carried out. The simulation technique is used to allow independent variables, including weather conditions, equipment costs, system life and fuel cost, to vary randomly and independently. A method of combining the three equally weighted criteria for each heating system is described. Dissert. Abstr.

N78-16424* + National Aeronautics and Space Administration, Washington, D. C.
ENERGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 14
Jul. 1977 410 p refs
(NASA-SP-7043(14)) Avail: NTIS HC E05 CSCL 10A
This bibliography lists 1000 reports, articles, and other documents introduced into the NASA scientific and technical information system from April 1, 1977 to June 30, 1977. Author

N78-16425 Texas Technological Univ., Lubbock.
OPTICAL ANALYSIS OF SPHERICAL SEGMENT SOLAR COLLECTORS Ph.D. Thesis
Billy Charles Brock 1977 281 p
Avail: Univ. Microfilms Order No. 77-25501
An approach for the calculation of optical flux distributions and power concentration ratios is described which can be applied for mirrors of any shape, illuminated by a source of arbitrary angular extent provided appropriate structure relations can be determined. The method is not restricted to single reflections but is valid for light which reflects from the mirrors any number of times. The work focuses on spherical mirror segments with conical receivers. The result is an extremely accurate expression for the conical power concentration. The method is also applicable for point source illumination. Dissert. Abstr.

N78-16426 Wisconsin Univ., Madison.
AN ASYNCHRONOUS ac/dc/ac LINK FOR WIND POWER APPLICATION Ph.D. Thesis
Bernard Thomas Merritt 1977 311 p
Avail: Univ. Microfilms Order No. 77-17842
It is proven that an asynchronous ac/dc/ac electric link is a practical way of converting the kinetic energy in the wind to electrical energy. The ac/dc/ac link termed a wind energy conversion system (WECS) consists of a wind driven polyphase alternator, rectifier, inductor, and an inverter tied to the existing utility grid. The laboratory investigations studied various alternator types, types of inverters, and types of inverter control. Based on these laboratory tests, a WECS consisting of a modified commercial aerogenerator, a three phase, six pulse bridge rectifier, a bus stabilizer, and a single phase, four pulse, bridge inverter was designed, built and installed. Dissert. Abstr.

N78-16427 Miami Univ., Coral Gables, Fla.
THREE-REGION WORLD DYNAMICS OF FOSSIL/HYDROGEN ENERGY SYSTEM Ph.D. Thesis
Nasser Sadat Forouzanmehr 1977 567 p
Avail: Univ. Microfilms Order No. 77-29996
The world had been grouped into three regions with respect to energy: developed countries, petroleum producing countries and developing countries. A three-regional model for analysis of the world energy problems was developed including world dynamics of the fossil/hydrogen system. The most important national, regional and global problems are identified. An explanation of why the attempts to deal with such problems have not been successful is given. Some useful statistical data for a period of almost two decades is summarized for use as basic data for the fundamental correlation and the initial input for system analysis. Dissert. Abstr.

N78-16428 Michigan Univ., Ann Arbor.
AN EXAMINATION OF SMALL WIND ELECTRIC SYSTEMS IN MICHIGAN Ph.D. Thesis
Barry Norbert Haack 1977 223 p
Avail: Univ. Microfilms Order No. 77-18041
The use of small wind powered generators for supplying electricity to individual households in Michigan is examined. Small wind electric systems are not currently economically competitive with electricity from utility companies. Increasing costs of electricity from utility companies, governmental subsidies for individuals installing wind electric systems, or decreased capital costs of these systems as a result of large volume production may greatly increase the economic competitiveness of small wind electric systems. The net energy analysis of small wind electric systems concluded that these systems are energetically competitive with existing utility company's systems. Direct environmental impacts from the normal or abnormal operation of small wind electric systems appear to be slight but indirect environmental impacts, e.g., incurred during acquisition of materials for construction, may be considerable. Dissert. Abstr.

N78-16429# Committee on Energy and Natural Resources (U.S. Senate).
ECONOMIC IMPACT OF PRESIDENT CARTER'S ENERGY PROGRAM
Washington GPO 1977 182 p refs Hearing before Comm. on Energy and Natural Resources, 95th Congr., 1st Sess., 3 May 1977
(GPO-91-295; Publ-95-33)
The administration's national energy program was evaluated as to economic impact in regard to the consumer and energy prices, total energy savings, regional impacts, and energy supplies. The overall issue in question was whether or not the program can realistically be expected to meet legitimate national energy needs in 1985 and beyond. B.L.P.

N78-16430# Committee on Energy and Natural Resources (U.S. Senate).
IMPACT OF THE NATIONAL ENERGY PLAN
Washington GPO 1977 41 p refs Hearing before Comm. on Energy and Natural Resources, 95th Congr., 1st Sess., 19 May 1977
(GPO-91-909) Avail: Comm. on Energy and Natural Resources
A thorough review was made by the jurisdictional committees of Congress of President Carter's national energy plan. The impact of specific portions of the plan were analyzed in order to establish a realistic perspective with respect to the goals enunciated by the President. Topics covered include predicted energy savings, cost of the plan, costs to the industry of coal conversion and higher prices for consumers. B.L.P.

N78-16431*# National Aeronautics and Space Administration, Washington, D. C.
CONSIDERATIONS ON COAL GASIFICATION
J. E. Franzen Jan. 1978 34 p refs Transl. into ENGLISH from 'Einige Ueberlegungen zur Kohlevergasung' (West Germany), v. 35 Jan. 1977 p 83-94 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Tech. Mitt. Krupp, forschungsberichte
(NASA-TM-75233) Avail: NTIS HC A03/MF A01 CSCL 10B
Commercial processes for the gasification of coal with oxygen are discussed. The Koppers-Totzek process for the gasification of coal dust entrained in a stream of gasifying agents is described in particular detail. The outlook for future applications of coal gasification is presented. Author

N78-16432*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
TEST AND ANALYSIS OF A NORTHRUP COLLECTOR CONTROLLER
D. R. Scott, R. R. Kissel, and H. Reid Jan. 1978 24 p ref
(NASA-TM-78153) Avail: NTIS HC A02/MF A01 CSCL 10A
The collector controller was examined as a functioning control system that drives the Northrup collector from east to west to follow the sun then back to the east at sundown in readiness for the next sunrise. The major components were examined separately with particular emphasis placed on an analysis of the electronic drive circuit. Results are presented from hardware testing and analysis with recommended changes to improve the system. Author

N78-16433*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

THE SOLAR HEATING AND COOLING COMMERCIAL DEMONSTRATION PROGRAM: SOME EARLY PROBLEMS AND RESULTS

Robert L. Middleton Jan. 1978 31 p refs

(NASA-TM-78152) Avail: NTIS HC A03/MF A01 CSCL 10A

The activities of the Marshall Space Flight Center of the National Aeronautics and Space Administration in the technical evaluation of proposals, contracts definitions, and program management details are defined and discussed. The significant problems were summarized in both technical and management aspects of the program. It was concluded that the program has significantly stimulated additional solar effort by the program participants. It was also concluded that the use of conventional construction industry organization with design/competitive bid procedures and standards has maintained a cost effective program. Author

N78-16434*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

APPROXIMATE METHOD FOR CALCULATING FREE VIBRATIONS OF A LARGE-WIND-TURBINE TOWER STRUCTURE

Sankar C. Das and Bradford S. Linscott Dec. 1977 46 p refs

(Contract E(49-26)-1028)

(NASA-TM-73754; ERDA/NASA-1028/77/12) Avail: NTIS HC A03/MF A01 CSCL 10A

A set of ordinary differential equations were derived for a simplified structural dynamic lumped-mass model of a typical large-wind-turbine tower structure. Dunkerley's equation was used to arrive at a solution for the fundamental natural frequencies of the tower in bending and torsion. The ERDA-NASA 100-kW wind turbine tower structure was modeled, and the fundamental frequencies were determined by the simplified method described. The approximate fundamental natural frequencies for the tower agree within 18 percent with test data and predictions analyzed. Author

N78-16435*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PHOTOVOLTAIC REFRIGERATION APPLICATION: ASSESSMENT OF THE NEAR-TERM MARKET

Louis Rosenblum, William J. Bifano, William A. Poley, and Larry R. Scudder Dec. 1977 19 p

(Contract E(49-26)-1022)

(NASA-TM-73876; E-9476; DOE/NASA-1022/77/23) Avail: NTIS HC A02/MF A01 CSCL 10A

This foreign and domestic market assessment was performed as part of the Tests and Applications Project being conducted by NASA-LeRC as part of the Department of Energy's (DOE) National Photovoltaic Program. One of the objectives of that program was to stimulate the demand for photovoltaic power systems so that appropriate markets would be developed in concert with the increasing photovoltaic production capacity. The refrigeration application represented a possible market for photovoltaics; hence, a brief survey of potential applications was conducted. Both refrigerators and refrigeration systems were considered in the assessment although the primary emphasis is on refrigerators of 9 cu ft of less. Three user sectors were examined: (1) government, (2) commercial/institutional, and (3) general public. Author

N78-16436# Nagoya Univ. (Japan). Inst. of Plasma Physics.

PROPOSED HIGH-POWER MICROWAVE SOURCE USING A SUPERCONDUCTING CAVITY AS AN ENERGY STORAGE

Kazuo Minami Nov. 1977 33 p refs

(IPPJ-T-30) Avail: NTIS HC A03/MF A01

A new principle of a high-power microwave source using a superconducting cavity as an energy storage is proposed. Since the quality factors about 10 to the 11th power and the electric field strength up to 60 MV/m are presently attainable, microwaves with energy density up to 0.016J/cum can be stored in a superconducting cavity. The stored energy can be released, in a short time, by changing mechanically the coupling factor between the cavity and a waveguide circuit. The technical possibilities are discussed in Rome detail. It is emphasized that, although the economical feasibilities are not assured at this stage of technology, this energy storage can be used to produce high-power microwave pulses which are not available in usual microwave oscillators. The resonant frequency energy storage presented here can be applied to the experiments in nuclear fusion research, because it is suited to a long-pulse operation of the order of 1 msec with an output power greater than 10 MW. Author

N78-16437*# Motorola, Inc., Phoenix, Ariz. Semiconductor Group.

LASER-ZONE GROWTH IN A RIBBON-TO-RIBBON, RTR, PROCESS SILICON SHEET GROWTH DEVELOPMENT FOR THE LARGE AREA SILICON SHEET TASK OF THE LOW COST SILICON SOLAR ARRAY PROJECT Annual Report

R. W. Gurtler and A. Baghdadi Sep. 1977 121 p Sponsored in part by ERDA Prepared for JPL

(Contracts NAS7-100; JPL-954376)

(NASA-CR-155586; ERDA/JPL-954376-77/4) Avail: NTIS HC A06/MF A01 CSCL 10A

A ribbon-to-ribbon process was used for routine growth of samples for analysis and fabrication into solar cells. One lot of solar cells was completely evaluated: ribbon solar cell efficiencies averaged 9.23% with a highest efficiency of 11.7%. Spherical reflectors have demonstrated significant improvements in laser silicon coupling efficiencies. Material analyses were performed including silicon photovoltage and open circuit photovoltage diffusion length measurements, crystal morphology studies, modulus of rupture measurements, and annealing/gettering studies. An initial economic analysis was performed indicating that ribbon-to-ribbon add-on costs of $.10/watt might be expected in the early 1980's. Author

N78-16438*# General Electric Co., Philadelphia, Pa. Valley Force Space Center.

SOLAR ARRAY CONCEPTUAL DESIGN FOR THE HALLEY'S COMET ION DRIVE MISSION, PHASE 2 Final Report

G. J. Rayl, K. M. Speight, and R. W. Stanhouse 31 Aug. 1977 87 p Prepared for JPL

(Contracts NAS7-100; JPL-954393)

(NASA-CR-155594; Doc-77SDS4243) Avail: NTIS HC A05/MF A01 CSCL 10A

Conceptual design studies were performed directed toward a high power, ultralightweight solar array, compatible with the requirements for the Halley's Comet Ion Drive Mission. A planar, rollup array design concept capable of producing 120 kW at 1 AU and 6 kW at 4.5 AU, and a concentrator, rollup array design concept capable of producing 60 kW at 1 AU and 15.5 kW at 4.5 AU evolved. Both arrays make maximum use of thin film, lightweight technology. The Halley's Comet spacecraft and mission requirements developed from preliminary definition to a more finalized and mature design. As solar array requirements were updated, conceptual design iterations were necessary to keep pace with the rapidly changing program objectives and goals. The Halley's Comet Mission program status and design approaches were reviewed and more realistic power requirements at 4.5 AU for the ion engines were established at the 12 to 16 kW range. This higher power necessitated a change from the planar array design to a concentrator array design in order to remain within suitable cost and weight objectives. Author

N78-16439*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.

SPRAYLON FLUOROCARBON ENCAPSULATION FOR SILICON SOLAR CELL ARRAYS Final Report

Jun. 1977 130 p refs Prepared for JPL

(Contracts NAS7-100; JPL-954410)

(NASA-CR-155593; LMSC-D558143) Avail: NTIS HC A07/MF A01 CSCL 10A

A development program was performed for evaluating, modifying, and optimizing the Lockheed formulated liquid transparent filmforming Spraylon fluorocarbon protective coating for silicon solar cells and modules. The program objectives were designed to meet the requirements of the low-cost automated solar cell array fabrication process. As part of the study, a computer program was used to establish the limits of the safe working

stress in the coated silicon solar cell array system under severe thermal shock. Author

N78-16440*# Rockwell International Corp., Anaheim, Calif. Autonetics Group.
ACCELERATED/ABBREVIATED TEST METHODS OF THE LOW-COST SILICON SOLAR ARRAY PROJECT. STUDY 4, TASK 3: ENCAPSULATION Interim Report, 1 Apr. 1976 - 24 Oct. 1977
J. M. Kolyer and N. R. Mann 24 Oct. 1977 131 p refs Sponsored in part by ERDA Prepared for JPL
(Contracts NAS7-100; JPL-954458)
(ERDA/JPL-954458-77/2) Avail: NTIS HC A07/MF A01 CSCL 10A

Methods of accelerated and abbreviated testing were developed and applied to solar cell encapsulants. These encapsulants must provide protection for as long as 20 years outdoors at different locations within the United States. Consequently, encapsulants were exposed for increasing periods of time to the inherent climatic variables of temperature, humidity, and solar flux. Property changes in the encapsulants were observed. The goal was to predict long term behavior of encapsulants based upon experimental data obtained over relatively short test periods. Author

N78-16441*# Texas Instruments, Inc., Dallas.
LARGE AREA CZOCHRALSKI SILICON Final Report
Samuel N. Rea and Paul S. Gleim Apr. 1977 151 p refs Sponsored in part by ERDA Prepared for JPL
(Contracts NAS7-100; JPL-954475)
(NASA-CR-155590; ERDA/JPL-954475-77/4; TI-03-77-23) Avail: NTIS HC A08/MF A01 CSCL 10A

The overall cost effectiveness of the Czochralski process for producing large-area silicon was determined. The feasibility of growing several 12 cm diameter crystals sequentially at 12 cm/h during a furnace run and the subsequent slicing of the ingot using a multiblade slurry saw were investigated. The goal of the wafering process was a slice thickness of 0.25 mm with minimal kerf. A slice + kerf of 0.56 mm was achieved on 12 cm crystal using both 400 grit B4C and SiC abrasive slurries. Crystal growth experiments were performed at 12 cm diameter in a commercially available puller with both 10 and 12 kg melts. Several modifications to the puller hoz zone were required to achieve stable crystal growth over the entire crystal length and to prevent crystallinity loss a few centimeters down the crystal. The maximum practical growth rate for 12 cm crystal in this puller design was 10 cm/h, with 12 to 14 cm/h being the absolute maximum range at which melt freeze occurred. Author

N78-16442*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
TRANSPARENT SUPERSTRATE TERRESTRIAL SOLAR CELL MODULE Final Report
Oct. 1977 112 p Sponsored in part by ERDA Prepared for JPL
(Contracts NAS7-100; JPL-954653)
(NASA-CR-155588; ERDA/JPL-954653-77/1; LMSC-D573729) Avail: NTIS HC A06/MF A01 CSCL 10A

The design, development, fabrication, and testing of the transparent solar cell module were examined. Cell performance and material process characteristics were determined by extensive tests and design modifications were made prior to preproduction fabrication. These tests included three cell submodules and two full size engineering modules. Along with hardware and test activity, engineering documentation was prepared and submitted. Author

N78-16443# Mallory (P. R.) and Co., Inc., Burlington, Mass. Lab. for Physical Science.
SEALED PRIMARY LITHIUM-INORGANIC ELECTROLYTE CELL Interim Report, 1 Mar. 1974 - 31 Jul. 1977
A. N. Dey Nov. 1977 190 p refs
(Contract DAAB07-74-C-0109; DA Proj. 1S7-62705-AH-94) (AD-A047054; ECOM-74-0109-13) Avail: NTIS HC A09/MF A01 CSCL 10/3

This report summarizes the R and D activities carried out by P. R. Mallory and Company on the development of a primary Li/SOCl2 D cell. The original objective of this program was to develop a D cell which is storable and operable in the temperature range of -40 to 160 F and is capable of delivering in excess of 150 WHr/lb at the thirty hour rate and peak power density of 50 watts/lb and a capacity degradation of less than 10% after one month of storage at 160 F. We showed that all the above objectives can be met by the hermetic Li/SOCl2 D cells developed by us. However, we found that the system suffered from two inherent deficiencies: (a) A voltage delay, particularly at low temperatures after high temperature storage. (b) A chemical instability that led to an explosion hazard, particularly on shorting and forced as well as on resistive load overdischarge. We studied the voltage-delay problem in sufficient detail to define its underlying causes and developed several methods for alleviating it. Lowering the electrolyte salt (LiAlCl4) concentration as well as a partial discharge alleviated the voltage delay to an extent that the cells show no voltage delay after a storage of 1 month at 72 C and test at -30 C at currents of 0.25, 1.0 and 3.0A. We consider the problem to be essentially solved for all practical purposes. We pursued both a physical and a chemical approach to solve the explosion hazard problem. We found that low pressure venting is an effective way of preventing cell explosions on external shorts. However, this approach was ineffective in preventing explosions from forced over discharge. Also, on occasion the cells exploded on resistive load overdischarge. GRA

N78-16444# Argonne National Lab., Ill. Engineering Div.
EXPERIMENTAL TWO-PHASE LIQUID-METAL MAGNETOHYDRODYNAMIC GENERATOR PROGRAM Annual Report, Aug. 1975 - Sep. 1976
M. Petrick, G. Fabris, E. S. Pierson, D. Carl, and A. K. Fischer Sep. 1977 101 p refs
(Contract N00014-76-F-0026)
(AD-A046951; ANL-MHD-77-3) Avail: NTIS HC A06/MF A01 CSCL 10/2

The revised ambient-temperature NaK-nitrogen facility is described. The maximum liquid flow rate and generator inlet pressure are 10.9 kg/s (200 gpm) and 1.48 MPa absolute (200 psig), respectively, compared with the previous values of 6 kg/s (110 gpm) and 0.72 MPa absolute (90 psig). Satisfactory loop operation has been obtained, and new experiments with the second diverging-channel generator were completed. The principal experimental results were a higher density for the same generator operating conditions, and an apparent tendency for the efficiency to improve more with increasing quality at higher velocities than lower velocities. An evaluation of an annular generator geometry is presented. The advantages and disadvantages of the geometry are described, the equations developed, and solutions obtained for three cases--constant velocity and no armature reaction, laminar flow with no armature reaction, and armature reaction with constant velocity. Numerical examples show that: (1) the attainable terminal voltages appear to be very low, (2) flow reversal and large viscous loss occurs at or below the desired power densities, and (3) armature reaction effects are important and compensation techniques appear impractical. Thus, this annular geometry does not appear attractive for either generator or pump operation. GRA

N78-16445# Colorado School of Mines, Golden. Dept. of Geophysics.
EXPLORATION FOR GEOTHERMAL ENERGY ON OAHU, HAWAII Final Report
George V. Keller, Jose Souto, and Augustine B. Furumoto 10 Nov. 1977 42 p refs
(Contract N00014-76-C-0824)
(AD-A046954) Avail: NTIS HC A03/MF A01 CSCL 08/7

Most interest in geothermal development in Hawaii up to the present time has centered on the development of thermal energy at Kilauea Volcano on the Island of Hawaii. Several test wells have yielded encouraging results with respect to further development of geothermal energy (Keller, et al, 1974). However, nearly 80% of the population of Hawaii resides on the Island of Oahu. In view of the larger market for energy there, it is reasonable to review the potential for the occurrence of commercial geothermal resources on Oahu. GRA

N78-16446# Energy Research and Development Administration, Washington, D. C.
UNDERGROUND COAL GASIFICATION PROGRAM

Mar. 1977 32 p refs
(ERDA-77-51) Avail: NTIS HC A03/MF A01

A brief overview of the ERDA program to develop underground coal gasification (UCG) technology is provided. The UCG program is part of ERDA's overall strategy to create energy choices for the future. General descriptions of the concept and its potential applications are included. The objective of the UCG program is to develop commercially viable, underground gasification processes for extracting energy from coal. Through government and industry joint participation, the technology will be developed, proved on a large scale, and transferred to the private sector; data will be provided to predict the economics of a commercial operation. ERDA's objectives and its support of national energy goals are shown. ERA

N78-16447# Bituminous Coal Research, Inc., Monroeville, Pa.
GAS GENERATOR RESEARCH AND DEVELOPMENT: BI-GAS PROCESS Quarterly Report, Jan. - Mar. 1977
Apr. 1977 76 p Prepared in cooperation with Phillips Petroleum Co., Homer City, Pa.
(Contract EF-77-C-01-1207)
(FE-1207-29) Avail: NTIS HC A05/MF A01

The continuing objective of this program to develop processes for gasifying coal to produce high-Btu pipeline gas is discussed. Laboratory-scale coal gasification experimentation will be conducted concurrently with a process and equipment deveiopment unit (PEDU). With the aid of engineering subcontractor(s), a BI-GAS pilot plant facility was designed and constructed. The combined bench-scale and PEDU studies will be conducted to develop a fluidized bed methanation process for use in upgrading a coal-derived synthesis gas. At the bench-scale level, catalysts will be investigated under conditions imposed by the BI-GAS process. These conditions include high carbon monoxide concentrations, high pressure, and a 3/1 hydrogen to carbon monoxide ratio. ERA

N78-16448# Battelle Columbus Labs., Ohio.
HEAT SOURCE COMPONENT DEVELOPMENT PROGRAM Quarterly Report, Apr. - Jun. 1977
Ellis L. Foster, Jr., comp. Jul. 1977 63 p refs
(Contract W-7405-eng-92)
(BMI-X-683) Avail: NTIS HC A04/MF A01

Results of several experimental programs to develop components for advanced radioisotope heat source applications are described. The heat sources will be used in advanced static and dynamic power conversion systems. The specific component development efforts described include: improved selective and nonselective vents for helium release from the fuel containment; an improved reentry member and an improved impact member, singly and combined. The unitized reentry-impact member is under development to be used as a bifunctional ablator. The development of a unitized reentry-impact member was stopped and the efforts are being redirected to the evaluation of materials that could be used in the near term for the module housing of the general purpose heat source. ERA

N78-16449# Battelle Pacific Northwest Labs., Richland, Wash.
ANALYSIS OF ELECTRICITY PRODUCTION COSTS FROM THE GEOPRESSURED GEOTHERMAL RESOURCE
C. H. Bloomster and C. A. Knutsen Feb. 1977 75 p refs
(Contract EY-76-C-06-1830)
(BNWL-2192) Avail: NTIS HC A04/MF A01

The economics of the geopressured geothermal resource along the northern coast of the Gulf of Mexico was assessed. The costs of generating electricity from available methane were estimated. Methane content and selling prices were identified as important factors affecting the commercial potential of geopressured resources; therefore electrical generation must be viewed as a by-product of methane production. ERA

N78-16450# Brookhaven National Lab., Upton, N. Y.
LAND USE-ENERGY SIMULATION MODEL: A COMPUTER-BASED MODEL FOR EXPLORING LAND USE AND ENERGY RELATIONSHIPS
T. Owen Carroll, A. S. Kydes, and J. Sanborn Jun. 1977 69 p refs Prepared in cooperation with State University of New York, Stony Brook, N. Y.
(Contract EY-76-C-02-0016)
(BNL-50634) Avail: NTIS HC A04/MF A01

A simulation model with integrated capability for generating energy demand is disclosed. Its framework captures two essential features of the land use-energy utilization interaction; first, the spatial location of land use activity is implicit, and second, transportation energy demand is determined as an integral part of the spatial configuration. The model is divided both conceptually and computationally into three parts; the land use model, a submodel for transportation which provides the work and shop trip distributions for spatial allocation of activities within the land use submodel, and an energy submodel which determines the energy demand from the land use configuration. Specific types of applications of the computer model are described. The model was utilized to assess the energy demand of the Long Island region in New York, and it was applied to study the generic relationships between energy utilization and urban form. ERA

N78-16451# Brookhaven National Lab., Upton, N. Y. National Center for Analysis of Energy Systems.
OVERVIEW OF TECHNOLOGICAL-ECONOMIC MODELS FOR ENERGY POLICY ANALYSIS
David J. Behling, Jr., Ellen A. Cherniavsky, Kenneth C. Hoffman, and Dale W. Jorgenson (Harvard Univ.) 1977 29p refs Presented at Workshop on Energy Strategies, Laxenburg, Austria, 18 May 1977
(Contract EY-76-C-02-0016)
(BNL-22730; Conf-770549-1) Avail: NTIS HC A03/MF A01

The individual models that were assembled were the Hudson-Jorgenson model of the economy and interindustry transactions, and the Brookhaven energy system optimization model. Other data bases and fixed coefficient input/output models were employed as data sources and accounting frameworks to support this combined technological-economic model. The combined model was used to develop long range projections of energy-economic relationships and to perform cost/benefit analyses of the U. S. energy R and D programs. ERA

N78-16452# General Atomic Co., San Diego, Calif.
PRELIMINARY SYSTEM ANALYSIS OF A FIXED MIRROR SOLAR POWER CENTRAL STATION Final Report
J. L. Russell, Jr., G. Eggers, W. Emrich, F. Openshaw, and W. Walker Jun. 1977 74 p refs Sponsored by EPRI
(EPRI Proj. 739-1)
(EPRI-ER-434(6-77)) Avail: NTIS HC A04/MF A01

A preliminary systems design was performed and an evaluation made of a fixed mirror solar concentrator (FMSC). A computer program was written to model a preliminary system definition of a power plant design for an FMSC, and analytical models were developed to simulate the performance and to model the cost of subsystems using both heat transfer salt (HITEC) and carbon dioxide gas as the primary heat transfer fluids. It was found that the cost of the Hitec system was about one-half that of the CO2 system. The computer code was exercised to obtain preliminary plant cost estimates and data on the sensitivity of the plant cost to changes in design parameters. ERA

N78-16453# Institute of Gas Technology, Chicago, Ill.
ALTERNATIVE FORMS OF ENERGY TRANSMISSION FROM OTEC PLANTS
A. Konopka, N. Biederman, A. Talib, and B. Yudow 1977 12 p refs Presented at 4th Ocean Thermal Energy Conversion Conf., New Orleans, 22-24 Mar. 1977
(Contract EX-76-C-01-2426)
(CONF-770331-5) Avail: NTIS HC A02/MF A01

The transmission of OTEC-derived chemical and electrical energy is compared. The chemical energy-carriers considered are gaseous and liquid hydrogen, liquid ammonia, methanol, gasoline, hydrazine hydrate, anhydrous hydrazine, unsymmetrical dimethylhydrazine, 1,7-octadiyne, and tetrahydrodicyclopentadiene. The assessment assumes that each of the above energy carriers were transported by barge and/or pipeline. The delivered costs were then compared with transmission of electricity by submarine cables. In addition to presenting the delivered cost and overall energy efficiency of the chemical energy-carriers, a discussion of the equipment, costs, and efficiencies of converting the hydrogen and ammonia delivered into electricity, and the electricity delivered into hydrogen and ammonia is provided. ERA

N78-16454# Institute of Gas Technology, Chicago, Ill.
ALTERNATIVE ENERGY TRANSMISSION SYSTEMS FROM OTEC PLANTS, PROJECT 8980 Third Quarter Progress Report, 1 Jan. - 31 Mar. 1977
B. Yudow, A. Konopka, and N. Biederman May 1977 20 p refs
(Contract EX-76-C-01-2426)
(DSE/2426-12) Avail: NTIS HC A02/MF A01

Three types of thermal energy storage media were considered for transport of OTEC energy. They were the following: (1) sensible heat media, which depends upon the heat capacity of the material for energy storage, (2) latent heat of fusion material, and (3) reversible chemical reactions. Only those systems operating in the nominal temperature range of 400 to 1000 F were considered. Four thermal energy transport system concepts were selected and synthesized into conceptual systems that use OTEC energy to charge the thermal storage medium installed in a ship hull, then transported the heat storage system to shore for use, or converted the thermal energy to electricity using a heat engine. The four conceptual designs, of which two used sensible heat storage, one used the latent heat of fusion, and one used a reversible chemical reaction, were derived from thermal energy storage conceptual designs for solar thermal-electric power plants or solar total energy systems. ERA

N78-16455# Kaman Sciences Corp., Colorado Springs, Colo. Energy Systems Development Group.
SYSTEMS APPROACH TO SOLAR HEATING AND COOLING SYSTEMS
Douglas M. Jardine 1977 56 p Presented at Energy Environment Conf., Kansas City, Mo., 29 Mar. 1977; sponsored by Am. Defense Preparedness Assoc.
(CONF-770359-1) Avail: NTIS HC A04/MF A01

Various energy systems were tested and their operational characteristics determined for baseline type comparison. Systems included the direct utilization of stored thermal energy, air-to-air heat pumps, fluid-to-air heat pumps, and electric resistance heaters to supplement house heating and to add heat to thermal storage during off-peak hours. ERA

N78-16456# Los Alamos Scientific Lab., N. Mex.
ENERGY FLOW PATTERNS FOR 1975
R. B. Kidman, R. J. Barrett, and D. R. Koenig Jun. 1977 72 p refs
(Contract W-7405-eng-36)
(LA-6770) Avail: NTIS HC A04/MF A01

Highly visual and self-explanatory energy flow diagrams are presented for each of the 50 states, the 10 US Federal Standard Regions, and the entire United States. Each diagram illustrates the energy produced and how it is consumed or lost. The diagrams are meant to serve as a convenient and useful reference (or starting point) for consideration of energy-related problems. ERA

N78-16457# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
INDUSTRIAL APPLICATIONS OF SOLAR ENERGY Quarterly Report
Jan. 1977 255 p refs
(Contract EY-76-C-03-1132)
(SAN/1132-1) Avail: NTIS HC A12/MF A01

Solar energy systems were defined that are technically and economically feasible, and can satisfy all or part of selected industry demands. The market potential of such systems was determined. Total energy conceptual designs to be generated for selected industries and ranked for subsequent preliminary design selection were considered. Major efforts during this reporting period consisted of extending the program to include all of the United States, continued collection of demand data, selection of an insolation methodology, collector/conversion system trade studies, absorption/vapor cycle refrigeration trades, completion of the resizing of all first level designs, and initiation of the utility interface and market penetration investigation. ERA

N78-16458# Oak Ridge National Lab., Tenn.
TRANSMUTATION DOPING OF SILICON SOLAR CELLS
R. F. Wood, R. D. Westbrook, R. T. Young, and J. W. Cleland Apr. 1977 11 p refs Presented at the High Efficiency Radiation Damage Silicon Solar Cell Meeting, Cleveland, 28 Apr. 1977
(Contract W-7405-eng-26)
(CONF-770439-1) Avail: NTIS HC A02/MF A01

Normal isotopic silicon contains 3.05 percent of (Si-30) which transmutes to (P-31) after thermal neutron absorption, with a half-life of 2.6 hours. This reaction can be used to introduce extremely uniform concentrations of phosphorus into silicon, thus eliminating the areal and spatial inhomogeneities characteristic of chemical doping. Annealing of the lattice damage in the irradiated silicon does not alter the uniformity of dopant distribution. Transmutation doping also makes it possible to introduce phosphorus into polycrystalline silicon without segregation of the dopant at the grain boundaries. The use of neutron transmutation doped silicon in solar cell research and development is discussed. ERA

N78-16459# Sandia Labs., Albuquerque, N. Mex. Solar Project Div.
TOWER DESIGN CONSIDERATIONS FOR THE SOLAR THERMAL CENTRAL RECEIVER SYSTEMS
L. M. Murphy Jun. 1977 27 p refs
(Contract EY-76-C-04-0789)
(SAND-77-8243) Avail: NTIS HC A03/MF A01

Some basic design considerations for concrete solar thermal power towers are described. Seismic disturbances are of primary concern for the large towers being proposed for some commercial systems. For the larger receiver/tower systems the tower top accelerations due to seismic disturbances are not significantly amplified. However, the attachment of the more massive receivers may become more difficult for the larger systems. ERA

N78-16460# Stanford Univ., Calif. Electronics Labs.
SILICON PHOTOVOLTAIC CELLS IN THERMOPHOTOVOLTAIC CONVERSION Progress Report
R. M. Swanson and R. N. Bracewell Feb. 1977 27 p
(EPRI Proj. 790-1)
(EPRI-ER-478) Avail: NTIS HC A03/MF A01

A preliminary assessment of the feasibility of a solar-electric thermophotovoltaic (TPV) system was performed. The proposed system uses concentrating mirrors focused on a TPV converter that operates at high power density and potentially high efficiency. Within the TPV converter, the concentrated sunlight heats a refractory radiator. A photovoltaic cell faces the radiator, receives incandescent radiation from it, and converts the radiation to electricity. A numerical model of TPV conversion was developed to assess TPV conversion and to facilitate an initial design of TPV photocells. Also, a facility for experimentally evaluating TPV photocells was designed and built. ERA

N78-16461# Virginia Univ., Charlottesville. Dept. of Mechanical Engineering.
ENGINEERING ANALYSIS AND TESTING OF WATER-TRICKLE SOLAR COLLECTORS Progress Report, Jun. 1975 - Nov. 1976
J. T. Beard Jan. 1977 46 p refs
(Contract EY-76-S-05-4927)
(ORO-4927-77/1; PR-3) Avail: NTIS HC A03/MF A01

An outdoor solar collector testing facility was for the purpose of conducting thermal performance evaluations of the Thomason SOLARIS watertrickle solar collector. The facility was used for simultaneously testing four SOLARIS collector panels under different operational conditions of inlet water temperatures and flow rates with the same atmospheric exposure. A near linear relationship of steady-state efficiency for the SOLARIS collector is displayed as a function of the difference between inlet water temperature and the ambient temperature, divided by the incident solar energy. The scatter in the data, results from other variables which are analyzed, and includes glazing cleanliness, angle of incidence and wind. Various glazing materials were also examined, and performance curves are presented for the water trickle collector with a mylar film and Tedlar PVF film. ERA

N78-16462# Boeing Co., Seattle, Wash. Engineering and Construction Div.
TECHNICAL AND ECONOMIC ASSESSMENT OF PHASE CHANGE AND THERMOCHEMICAL ADVANCED THERMAL ENERGY STORAGE (TES) SYSTEMS. VOLUME 4: SOLAR POWER PLANT OPERATION, ANALYSIS COMPUTER

PROGRAM Final Report
Dec. 1976 182 p
(EPRI Proj. 788-1)
(EPRI-EM-256-Vol-4) Avail: NTIS HC A09/MF A01

The computer program used to simulate the operation of the high temperature gas cooled solar power plant is described. The program was used to assess the interrelations of plant components as opposed to the design of the individual elements. The model estimates the effectiveness of the Brayton cycle solar power plant on an hourly, daily and yearly basis. A description of the program and how the program is used including inputs, outputs, outputs and operating instructions, was also included. ERA

N78-16463# National Bureau of Standards, Washington, D. C. Center for Building Technology.
PROVISIONAL FLAT PLATE SOLAR COLLECTOR TESTING PROCEDURES Interim Report
Sep. 1977 57 p refs
(Contract EA-77-A-01-6010)
(PB-272500; NBSIR-77-1305) Avail: NTIS HC A04/MF A01 CSCL 10A

Test methods are presented for use in determining the thermal performance, and to aid in the assessment of the safety and durability/reliability of flat plate solar collectors. These test methods and rating criteria were selected after the review of over 400 accepted industry standards and are consistent with the intent of the U. S. Department of Housing and Urban Development Minimum Property Standards and the Interim Performance Criteria prepared by the National Bureau of Standards for ERDA and HUD respectively. GRA

N78-16464# McDonnell-Douglas Astronautics Co., Richland, Wash. Energy Lab.
IMPLANTED ENERGY CONVERSION SYSTEM Annual Report, 1 Jun. 1976 - 1 May 1977
R. P. Johnston, L. P. Bakker, A. Bennett, S. G. Emigh, and G. M. Englesby Aug. 1977 215 p ref
(Contract N01-HV-4-2901)
(PB-272609/9; MDC-G4449; NIH-N01-HU-4-2901-4) Avail: NTIS HC A10/MF A01 CSCL 06L

The REL power source combines the high efficiency of Stirling engines with the reliability, efficiency, and flexibility of hydraulic power transfer and control to ensure long system life and physiological effectiveness. Extended life testing was achieved with an engine and hydraulic actuator/controller. Peak power source efficiency is 15.5% on 5.10 watts delivered to the blood pump push plate with 33 watts steady thermal input. Planned incorporation of power source output control was expected to reduce daily average thermal input to 18 watts. Animal in-vivo tests with an assist heart consistently demonstrated required performance by biological synchronization and effective ventricle relief. GRA

N78-16465# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
PRELIMINARY ENVIRONMENTAL ASSESSMENT OF SOLAR ENERGY SYSTEMS Final Report
D. Richard Sears and Paul O. McCormick Aug. 1977 134 p refs
(Contract EPA-68-02-1331)
(PB-272352/6; LMSC-HREC-TR-D496748; EPA-600/7-77-086) Avail: NTIS HC A07/MF A01 CSCL 10A

The environmental consequences of three kinds of solar energy utilization: photovoltaic concentrator (steam electric) and flat plate are addressed. The application of solar energy toward central power generating stations was emphasized. Discussions of combined modes and of the geosynchronous satellite generating stations are included. Author

N78-16466# Michaud, Cooley, Hallburg, Erickson, and Associates, Inc., Minneapolis, Minn.
EVALUATION OF COMPUTERIZED ENERGY PROGRAMS FOR THE CALCULATION OF ENERGY USE IN NEW AND EXISTING BUILDINGS Final Report
Oct. 1975 152 p
(Contract FEA-CO-04-50040-00)
(PB-272337/7; FEA/D-77/380) Avail: NTIS HC A08/MF A01 CSCL 10A

A number of existing load and energy computer programs were evaluated with relation to: the accuracy of the programs, the complexity of the programs to implement, and the cost to utilize the programs in order to determine whether any of the programs could be endorsed for use in meeting existing or promulgated state building codes for the design of new buildings and retrofit of existing buildings. GRA

N78-16467# Federal Energy Administration, Washington, D. C. Office of Economic Impact Analysis.
REPORT TO CONGRESS ON THE ECONOMIC IMPACT OF ENERGY ACTIONS
Jun. 1977 197 p refs
(PB-272080/3; FEA/B-77/371) Avail: NTIS HC A09/MF A01 CSCL 05C

The economic impact of last winter's natural gas supply problems was described and the impacts of specific FEA actions taken during that period were evaluated. Implemented energy actions, evaluated under the Economic Impact Evaluation Program and taken between 1 April 1976 and 1 July 1977 were summarized. An economic impact evaluation was performed for many proposed actions and their possible alternatives. GRA

N78-16468# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
A HYPOTHETICAL 1000 MW(e) PHOTOVOLTAIC SOLAR-ELECTRIC PLANT Final Environmental Impact Statement, 1 Apr. - 31 Jul. 1976
D. Richard Sears, Donald V. Merrifield, Morris M. Penny, and W. Glen Bradley (Environ. Consultants, Inc.) Jul. 1976 205 p refs
(Contract EPA-68-02-1331)
(PB-273108/1; LMSC-HREC-TR-D497914; EPA-600/7-77-085) Avail: NTIS HC A10/MF A01 CSCL 10B

The hypothetical plant is 1000 MWe silicon photovoltaic, located on 52 sq km of desert. The principal adverse environmental impacts expected relate to the destruction of soil and vegetation on 52 sq km of desert terrain. GRA

N78-16469# BDM Corp., Vienna, Va.
DOD PHOTOVOLTAIC ENERGY CONVERSION SYSTEMS MARKET INVENTORY AND ANALYSIS, VOLUME 1
Robert M. Terry, Clarence P. Carter, Judy Israel, Orin H. Merrill, and Michael G. Semmans Jun. 1977 219 p refs
(Contract FEA-CG-05-50081-1)
(PB-273969/6; FEA/G-77/282-Vol-1) Avail: NTIS HC A10/MF A01; also available in set of 3 reports HC E11 as PB-273968-SET CSCL 10B

The potential Department of Defense market for photovoltaic energy systems, and the potential role of the DOD in promoting industry and market development were estimated. The focus of the study is on delineating near term markets. GRA

N78-16470# BDM Corp., Vienna, Va.
DOD PHOTOVOLTAIC ENERGY CONVERSION SYSTEMS MARKET INVENTORY AND ANALYSIS, VOLUME 2
Robert M. Terry, Clarence P. Carter, Judy Israel, Orin H. Merrill, and Michael G. Semmans Jun. 1977 285 p refs 3 Vol.
(Contract FEA-CG-05-50081-1)
(PB-273970/4; FEA/G-77/283-Vol-2) Avail: NTIS HC A13/MF A01; also available in set of 3 reports HC E11, PB-273968-SET CSCL 10B

Topics discussed include: (1) Statement of work; (2) Near term application of photovoltaic energy systems--detailed data and results; (3) Long term application of photovoltaic energy systems--detailed data and results; (4) Combined energy systems; (5) Market survey of technology transfer potential of the Department of Defense photovoltaic applications; and (6) Technology transfer potentials for non-Department of Defense applications. Author

N78-16471# BDM Corp., Vienna, Va.
DOD PHOTOVOLTAIC ENERGY CONVERSION SYSTEMS MARKET INVENTORY AND ANALYSIS. SUMMARY VOLUME

Robert M. Terry, Clarence P. Carter, Judy Israel, Orin H. Merrill, and Michael G. Semmans Jun. 1977 40 p refs
(Contract FEA-CG-05-50081-1)
(PB-273971/2; FEA/G-77/362) HC A03/MF A01; HC also available in set of 3 reports PC e11, PB-273968-Set CSCL 10B

Estimates of the potential Department of Defense market for photovoltaic energy systems, and the potential role of the DOD in promoting industry and market development were provided. The focus was on delineating near term markets. It is hoped that rapid development of these markets will provide sufficient sales volume to promote industry automation and drive down the unit cost of photovoltaic energy systems to the point where large scale DOD and civilian markets will develop. GRA

N78-16472# George Washington Univ., Washington, D. C. Program of Policy Studies in Science and Technology.
LEGAL-INSTITUTIONAL IMPLICATIONS OF WIND ENERGY CONVERSION SYSTEMS (WECS), EXECUTIVE SUMMARY
Sep. 1977 39 p
(Grant NSF APR-75-19137)
(PB-273006/7; NSF/RA-770203) Avail: NTIS HC A03/MF A01 CSCL 10A

The legal issues presented by wind energy conversion systems (WECS) utilization are related to its structural and technological features, as well as to its economic and social implications. Some information about wind systems, their likely applications and problems, are briefly stated. The features of the existing legal structure which may facilitate the implementation of such systems are noted. The ways in which the legal situation varies with particular applications and which applications pose the greatest legal difficulties are summarized. The complex subject of offshore wind systems is discussed. GRA

N78-16473# Office of Technology Assessment, Washington, D. C.
ANALYSIS OF THE PROPOSED NATIONAL ENERGY PLAN
Aug. 1977 240 p refs
(PB-273148/7; OTA-E-51; LC-77-600034) Avail: NTIS HC A11/MF A01 CSCL 10A

The proposed National Energy Plan submitted to the Congress by the Carter Administration in April, 1977 is analyzed. The Administration's proposals and their technical, environmental, social, and economic impacts are discussed according to the Plan's impacts on energy supply, energy demand, and society. GRA

N78-16474# New York Univ., N. Y.
CONSEQUENCES OF NEW ENERGY PATTERNS Final Report
Lawrence Fishbein (Natl. Center for Toxicol. Res.) Dec. 1976 39 p refs
(Grant PHS-1-R13-ES-01470-01)
(PB-273259/2; NIH/NIEHS-77/005) Avail: NTIS HC A03/MF A01 CSCL 10A

The potential problem areas and research needs as a consequence of new energy patterns impacting on the nation's water sources and quality are reviewed in terms of trends in energy demand. Coal, oil, nuclear energy, geothermal energy and oil shale are covered. GRA

N78-16475# National Bureau of Standards, Washington, D. C.
SOLAR ENERGY SYSTEMS. SURVEY OF MATERIALS PERFORMANCE Final Report
L. F. Skoda and L. W. Masters Oct. 1977 115 p refs Sponsored by ERDA
(PB-273305/3; NBSIR-77-1314) Avail: NTIS HC A06/MF A01 CSCL 10A

Guidelines to aid the selection of materials for use in solar energy systems are given. Field inspections of approximately twenty-five operational solar energy systems were performed, and a questionnaire was sent to 459 manufacturers and installation contractors to obtain materials performance data. A primary conclusion is that the process of selecting materials for specific applications within solar energy systems is hindered by the lack of an adequate data base of materials performance under the conditions experienced in solar systems and subsystems. Recommendations are made that would help in establishing an improved data base. GRA

N78-16476# Environmental Research and Technology, Inc., Concord, Mass.
ENERGY CONSUMPTION OF ENVIRONMENTAL CONTROLS: FOSSIL FUEL, STEAM ELECTRIC GENERATING INDUSTRY Final Report
Brian Murphy, James R. Mahoney, David Bearg, Gale Hoffnayle, and Joel Watson Aug. 1977 199 p refs
(Contract EPA-IAG-D6-E091)
(PB-273019/0; ERT-P-1839; EPA-600/7-77-101) Avail: NTIS HC A09/MF A01 CSCL 10B

The energy requirements for environmental control in the fossil fuel, steam electric industry are discussed. These requirements are computed for a variety of energy policy 'scenarios' to demonstrate the impact of altering current environmental regulations or of utilizing alternate strategies for achieving environmental goals. In particular, the effect of requiring 'Best Available Control Technologies' for power plants, of using tall stacks and/or supplementary control systems, and of using coal washing and/or blending to decrease the necessity for 'scrubbers' are examined in different scenarios. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N78-16477 Pennsylvania State Univ., University Park.
SONIC AGGLOMERATION OF SUBMICRON PARTICLES Ph.D. Thesis
Michael Volk, Jr. 1977 306 p
Avail: Univ. Microfilms Order No. 77-23282

Experimental and theoretical studies of the effects of sound on the agglomeration of airborne particles were carried out to determine the feasibility of using sonic agglomeration as a means of enhancing the collection efficiency of electrostatic precipitators. A special constructed agglomeration chamber was used to investigate the effects of particle density, structure, size distribution and concentration as well as sound intensity and exposure time. Aerosols consisting of carbon black, kaolin clay, white lead and fly ash were used. It was found that the rate of agglomeration increases with increasing concentration, sound pressure level and exposure time, and with decreasing particle size. There appears to be an optimum frequency at which the rate of agglomeration passes through a maximum. Dissert. Abstr.

N78-16478 Oregon State Univ., Corvallis.
EVALUATION OF AN APPROACH FOR STUDYING THE QUANTITATIVE RESPONSES OF WHOLE ORGANISMS TO MIXTURES OF ENVIRONMENTAL TOXICANTS Ph.D. Thesis
Carl Frank Muska 1977 83 p
Avail: Univ. Microfilms Order No. 77-29421

An approach previously proposed for studying the effects of mixtures of environmental toxicants on the quantal responses of whole organisms was evaluated in terms of its applicability to quantitative response studies. Types of multiple toxicity were defined respectively as concentration, response, supra- and infra-addition. Hypothetical dose response curves and their respective isobole diagrams were used to illustrate the relationships between the types of toxicant interaction discussed. The effects of copper, nickel, and dieldrin and selected mixtures of these compounds on the relative growth and food consumption rates of juvenile guppies fed a restricted and an unrestricted ration of tubificid worms were expressed as a function of the natural logarithm of toxicant concentration. Dissert. Abstr.

N78-16479 Florida Univ., Gainesville.
HEAVY METAL INTERACTIONS WITH NATURAL ORGANICS IN AQUATIC ENVIRONMENTS Ph.D. Thesis
Neil Edward Carriker 1977 165 p
Avail: Univ. Microfilms Order No. 77-29228

Analyses of concentration of eight heavy metals in several components of cypress domes showed that sediments and floating

aquatic plants are the principal heavy metal sinks in these systems. Water samples from shallow wells surrounding the domes showed no evidence of heavy metal contamination of groundwater. Laboratory investigations demonstrated the general utility of duckweed in heavy metal phytotoxicity studies and revealed that organic fractions from both sewage and natural organic color complex gave significant amounts of heavy metals. Heavy metal interactions with these natural and sewage organics and with four model organic compounds were investigated by a variety of techniques including ultrafiltration, atomic absorption spectrophotometry, ion-selective electrodes, differential pulse anodic stripping voltammetry, and ion exchange equilibrium methods.
Dissert. Abstr.

N78-16480 Georgia Univ., Athens.
EFFECTS OF MAN UPON THE GEOMORPHOLOGY OF THE RAMPART RANGE, COLORADO Ph.D. Thesis
Charles Leroy Smith 1977 247 p
Avail: Univ. Microfilms Order No. 77-29806

A 50 mile long segment of the Rocky Mountains and adjacent portions of the Great Plains were studied to better understand the magnitude of man's changes to the environment, as related to population density, existing technology, and scale of landforms or relief within the area. Man's role as a modifier of the environment was investigated through an analysis of the many forms of land use employed in the region. The study was divided into 3 periods of time based on the level of technology. Results indicate strong correlations between the level of technology and the nature of destructive changes to the environment. The more significant alterations have occurred in areas of the densest population and lesser landforms. Dissert. Abstr.

N78-16481*# National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.
WATER HYACINTHS FOR UPGRADING SEWAGE LAGOONS TO MEET ADVANCED WASTEWATER TREATMENT STANDARDS, PART 2
B. C. Wolverton and Rebecca C. McDonald Oct. 1976 25 p refs
(NASA-TM-X-72730) Avail: NTIS HC A02/MF A01 CSCL 13B

Field tests using water hyacinths as biological filtration agents were conducted in the Mississippi gulf coast region. The plants were installed in one single cell and one multiple cell sewage lagoon systems. Water hyacinths demonstrated the ability to maintain BOD5 and total suspended solid (TSS) levels within the Environmental Protection Agency's prescribed limits of 30 mg/lBOD5 and 30 mg/l TSS. A multiple cell sewage lagoon system consisting of two aerated and one water hyacinth covered cell connected in series demonstrated the ability to maintain BOD5 and TSS levels below 30 mg/l year-round. A water hyacinth covered lagoon with a surface area of 0.28 hectare containing a total volume of 6.8 million liters demonstrated the capacity to treat 437,000 to 1,893,000 liters of sewage influent from 2.65 hectares of aerated lagoons daily and produce an effluent that met or exceeded standards year-round. Author

N78-16482# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON ENVIRONMENTAL QUALITY, NO. 156
6 Jan. 1978 73 p Transl. into ENGLISH from Selected Foreign Periodicals (Brazil)
(JPRS-70433) Avail: NTIS HC A04/MF A01

Translations from the world press of articles and press commentary are presented on environmental pollution and its effects, as well as pollution control technology, organizations, and programs. Author

N78-16483# Exxon Research and Engineering Co., Linden, N. J.
EFFECT OF HYDROCARBON COMPOSITION ON OXIDANT-HYDROCARBON RELATIONSHIPS. PHASE 2. BLEND OF TOTAL HYDROCARBON EMISSIONS Final Report
T. R. Powers Sep. 1977 110 p
(Contract EPA-68-02-1719)
(PB-273219/6; EPA-600/3-77-109b) Avail: NTIS HC A06/MF A01 CSCL 07D

Chamber irradiations were conducted using a hydrocarbon blend representing total hydrocarbon emissions in order to assess the formation of atmospheric oxidants resulting from exhaust emitted by catalyst-equipped vehicles. Results were compared with previous irradiation results using a hydrocarbon blend representing nonmethane, nonacetylene exhaust emissions from noncatalyst vehicles or catalyst-equipped vehicles. The blend representing total hydrocarbon emissions produced significantly less oxidants than either of the other two blends. GRA

N78-16484# Naval Surface Weapons Center, White Oak, Md.
PROCEEDINGS OF THE CONFERENCE ON THE ENVIRONMENTAL EFFECTS OF EXPLOSIVES AND EXPLOSIONS, 2D Final Report
George A. Young 25 Jul. 1977 165 p refs
(AD-A046880; NSWC/WOL/TR-77-36) Avail: NTIS HC A08/MF A01 CSCL 06/6

This report is a compilation of papers presented at the Second Conference on the Environmental Effects of Explosives and Explosions. The topics covered included: biological processes in liquid wastes; purification of liquid wastes; biological effects of underwater explosions; and noise abatement. Author (GRA)

N78-16485# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
AN EFFICIENT COMPUTATIONAL ALTERNATIVE TO USING LINEAR PROGRAMMING TO DESIGN OIL POLLUTION DETECTION SCHEDULES
Lee E. Daniel, Jr., Sandal Hart, and Thom J. Hodgson Oct. 1977 16 p refs
(Contract N00014-76-C-0096)
(AD-A047028; RR-77-9) Avail: NTIS HC A02/MF A01 CSCL 12/1

In Olson, Wright, and McKell's recent paper on the design of oil pollution detection schedules, an interesting and inventive development and application of a Markov Decision Process was presented. Optimal schedules for patrol flights of surveillance aircraft were found using linear programming. In this paper the model has been reformulated as a discrete time semi-Markov process. Significant computational advantages accrue from this alternative approach. Author (GRA)

N78-16486# Argonne National Lab., Ill.
AIR QUALITY ASSESSMENT FOR AIR FORCE OPERATIONS - LONG-TERM EMISSION/DISPERSION COMPUTER CODE DOCUMENTATION Final Report, 1 Jul. 1975 - 1 Jan. 1977
Dorothy J. Bingaman Apr. 1977 253 p refs
(AF Proj. 1900)
(AD-A047296; CEEDO-TR-76-35) Avail: NTIS HC A12/MF A01 CSCL 13/2

The Air Force contracted with Argonne National Laboratory to develop a series of computer programs designed to assess the air quality impact of Air Force operations at the airbase level. This report serves as a computer code documentation manual for the long-term emission/dispersion model of that effort. Descriptions of the computer codes corresponding to both the original version called the Research Model and the modified version called the Applications Model of the Long-Term Model are included. The manual contains flow charts, code listings, and brief descriptions of each routine contained in the model. It is intended primarily for readers with a computer programming background who wish to examine or alter the computer codes. GRA

N78-16487# Environmental Protection Agency, San Francisco, Calif. Region IX.
FINAL EIS/EIR LAS VIRGENES-TRIUNFO MALIBU-TOPANGA AREA WIDE FACILITIES PLAN Final Report
Sep. 1977 477 p Prepared in cooperation with Edaw, Inc., Newport Beach, Calif.
(PB-273524/9) Avail: NTIS HC A21/MF A01 CSCL 13B

Specific elements of the proposed facilities plan for the Las Virgenes Municipal Water District (LVMWD)- Triunfo County Sanitation District area were defined and analyzed. The Calabasas Reclaimed Water Line was emphasized along with improvements to the solids handling capability of LVMWD's Tapia Water

Reclamation Facility. Various alternatives are presented and preferred alternatives are recommended for both projects. GRA

N78-16488# Environmental Protection Agency, San Francisco, Calif.
FINAL EIS/EIR LAS VIRGENES-TRIUNFO-MALIBU-TOPANGA AREA WIDE FACILITIES PLAN. VOLUME 2: APPENDICES Final Report
1976 583 p refs Prepared in cooperation with Edaw, Inc., Newport Beach, Calif.
(PB-273525/6) Avail: NTIS HC A25/MF A01 CSCL 13B

Public hearings were held on the Draft EIS/EIR Las Virgenes-Triunfo-Malibu-Topanga Areawide Facilities Plan. Verbal testimony, given by many area citizens was received at the public hearings, and are summarized. If a citizen or spokesperson for a group or government agency also submitted a written comment then all comments from that person or agency are grouped together with the written comment following the verbal testimony. Responses are likewise grouped after the comment of each person or agency. GRA

N78-16489# Institute for Defense Analyses, Arlington, Va.
AIRCRAFT EMISSIONS: POTENTIAL EFFECTS ON OZONE AND CLIMATE: A REVIEW Final Progress Report
R. C. Oliver, E. Bauer, H. Hidalgo, K. A. Gardner, and W. Wasylkiwskyj Mar. 1977 404 p refs
(Contract DOT-FA76WA-3757)
(AD-A040638; P-1207; FAA-EQ-77-3) Avail: NTIS HC A18/MF A01 CSCL 04/1

A critical review is made of information relative to effects of aircraft emissions (NOx, SO2, H2O) projected to 1990 on the earth's protective ozone shield and on mean surface temperature, as estimated from appropriate mathematical models. Potential biological effects are not reviewed. The review provides information showing the large uncertainties in computations of effects on ozone, due to uncertainties in NOx emission indices (accepted values may be several-fold low), in chemistry, in troposphere-stratosphere interchange processes, and in future stratospheric composition (principally chlorine content); estimates of effects can be expected to change as new data are obtained. Current results indicate that aircraft NOx effects on the ozone column change sign with aircraft altitude: subsonic aircraft, cruising at 6-km to 14-km altitude, enhance or have almost no effect on the ozone column; supersonic aircraft (mach-2 class), cruising at 16-km to 19-km, reduce total ozone, but, for given NOx rates, by amounts less than previously reported. Computations based on a 'high' (rapid growth) estimate for the 1990 total fleet of subsonic and supersonic aircraft, assuming current engines and accepted NOx emission indices, including an estimated 142 Concordes and Tupolevs, showed an average ozone enhancement in the Northern Hemisphere of about 0.4 percent to 0.9 percent, varying with season. GRA

N78-16490# West Virginia Univ., Morgantown.
GENERATION AND SIMULATION OF METALLIC PARTICULATE AIR POLLUTANTS BY ELECTRIC ARC SPRAYING Final Report, Jul. 1973 - Jan. 1975
B. Linsky, R. Hedden, M. Naylor, and F. Dimmick Sep. 1977 336 p refs
(Contract EPA-R-801858)
(PB-273357/4; EPA-600/2-77-201) Avail: NTIS HC A15/MF A01 CSCL 14B

Results of efforts are given to provide a generated output with an appropriate mass and concentration of fresh, dry, fine metal oxide particles for bench or pilot scale fine particulate collection research and development work. The work involved two electric arc aerosol generators: one using a single consumable electrode of welding wire; the other, two consumable wire electrodes of a commercially available electric arc metallizer. The generated aerosols were exhausted into a duct system and sampled using membrane filters. The single electrode generator produced 0.67 g/cu m of 0.1 micrometer diameter iron oxide particles as sampled by an Andersen stack sampler. The mass emission rate with an average of 1.95 g/min varied within a + or - 12% range. GRA

N78-16491# Interpoll, Inc., St. Paul, Minn.
INSTRUMENTATION FOR MONITORING THE OPACITY OF PARTICULATE EMISSIONS CONTAINING CONDENSED WATER Final Report, Jun. 1975 - Jun. 1976
Milos Tomaides Aug. 1977 46 p
(Contract EPA-68-02-2225)
(PB-273394/7; EPA-600/2-77-124) Avail: NTIS HC A03/MF A01 CSCL 13B

The instrument continuously extracted and measured the opacity of representative samples of particulate effluent. It discriminated between pollutant particles and condensed water by increasing the temperature of the sample and vaporizing the condensed moisture. The opacity of the remaining particles was measured with any commercially available high precision optical transmissometer. The instrument was successfully field tested on (1) the effluent from a furnace of an expended perlite manufacturing plant and (2) the effluent from a wet scrubber of a sludge incinerator. GRA

N78-16492# Research Corp. of New England, Wethersfield, Conn.
RANKED INPUT AND OUTPUT DATA USED TO DETERMINE IMPACT OF NEW SOURCE PERFORMANCE STANDARDS FOR PARTICULATE MATTER, NITROGEN OXIDES, AND SULFUR OXIDES Final Task Report, Jul. 1974 - Jul. 1976
Thomas G. Hopper and William A. Marrone Apr. 1977 641 p
(Contract EPA-68-02-1382)
(PB-273785/6; EPA-450/3-76-019B) Avail: NTIS HC A99/MF A01 CSCL 13B

The purpose is to present the results of a study to determine the impact of new source performance standards on nationwide emissions. The work covers 14 potential pollutants from approximately 200 source categories for the year 1985. The results are being used by EPA as input to the development of an overall standard setting strategy. Information regarding controlled and uncontrolled emission factors, State emission limitations, industrial capacity, utilization, growth and retirement rates were studied. GRA

N78-16493# Virginia Univ., Charlottesville. Dept. of Chemistry.
ELECTRICAL DETECTION PROBLEMS IN WATER ANALYSIS BY SPARK SOURCE MASS SPECTROMETRY Final Report
W. W. Harrison Oct. 1977 48 p refs
(Grant EPA-R-801829-03-0)
(PB-273822/7; EPA-600/4-77-042) Avail: NTIS HC A03/MF A01 CSCL 13B

Research on factors affecting accuracy in spark source mass spectrometry (SSMS), and the application of SSMS to water related problems is described. This project has also involved the development of instrumental additions to improve the operation and control of SSMS procedures, particularly with respect to making the technique more quantitative and easier to use. The application of SSMS to specific sample types is also demonstrated. GRA

N78-16494# Northwestern Univ., Evanston, Ill. Dept. of Chemical Engineering.
INTERFACIAL EFFECTS IN THE RECOVERY OF RESIDUAL OIL BY DISPLACEMENT: STUDIES AT NORTHWESTERN UNIVERSITY Annual Report, 1 Mar. 1976 - 28 Feb. 1977
J. C. Slattery and J. C. Kovitz Mar. 1977 12 p refs
(Contract EY-76-S-02-0039)
(COO-0039-5) Avail: NTIS HC A02/MF A01

A static analysis is reported of the displacement of an oil segment by an aqueous surfactant solution through a capillary whose radius is a sinusoidal function of axial position. The displacement is recognized as a dynamic process. The first dynamic problem was made as simple as possible while still preserving some degree of realism. An analysis of the displacement of a gas by a liquid in a straight capillary tube of uniform diameter assuming that the interface moves with a constant speed is being conducted. ERA

N78-16495# Institute for Energy Analysis, Oak Ridge, Tenn.
PRESENT AND FUTURE PRODUCTION OF CO2 FROM FOSSIL FUELS: A GLOBAL APPRAISAL
R. M. Rotty Jun. 1977 22 p refs

(Contract EY-76-C-05-0033)
(ORAU/IEA(O)-77-15) Avail: NTIS HC A02/MF A01

Levels of atmospheric carbon dioxide, a question of world-wide proportions, were investigated. It was stated that unilateral action by any one nation in planning alternatives to fossil fuel use will be ineffective in controlling carbon dioxide. Energy growth in the past has been largely based on fossil fuels and, consequently, the annual carbon dioxide production has increased steadily at 4.3%. In 1976, the global carbon dioxide production contained more than 5 billion metric tons of carbon. Of this, 27% was a result of activity in the United States, but by 2025 the total will have grown more than fivefold with the developing countries and communist Asia producing over half the global total. The challenge to the United States is to develop energy supply systems not based on fossil fuels which can and will be used by developing nations. ERA

N78-16496# Brookhaven National Lab., Upton, N. Y.
INDIVIDUAL AIR POLLUTION MONITORS. 2: EXAMINATION OF SOME NONOCCUPATIONAL RESEARCH AND REGULATORY USES AND NEEDS
M. G. Morgan (Carnegie-Mellon Univ.) and S. C. Morris Jan. 1977 11 p refs
(Contract EY-76-C-02-0016)
(BNL-50637-2) Avail: NTIS HC A02/MF A01

The relationship between ambient air pollution levels measured at fixed monitoring stations and the actual exposure of the population was investigated. Available data were examined for carbon monoxide and sulfur dioxide and an analysis was presented. Actual population exposure to CO appears to be consistently higher than expected from fixed station data, while limited evidence suggests that exposures to SO2 are lower. A reported general relationship between indoor and outdoor levels of SO2 is not supported by the data. It was suggested that more attention be given to total population exposure to pollutants. A selective use of individual air pollution monitors, that can be worn or carried, appears to be required to uncover the relationship between air pollution exposure and health. ERA

N78-16497# MSA Research Corp., Evans City, Pa.
EMERGENCY COLLECTION SYSTEM FOR SPILLED HAZARDOUS MATERIALS Final Report
Ralph H. Hiltz and Ferdinand Roehlich, Jr. Aug. 1977 97 p
(Contract EPA-68-03-0206)
(PB-272790/7; MSAR-76-35; EPA-600/2-77-162) Avail: NTIS HC A05/MF A01 CSCL 13B

A prepackaged pumping and storage system for the collection and temporary containment of hazardous land spills was designed and two models developed. Each model includes a pump, hoses, furled self-deploying 26,500 l capacity plastic bag array all mounted on a pallet for transporting by pickup truck. The first model also includes batteries, electric motor, and starter, while the improved second model carries a gasoline powered pump engine and fuel. Nominal pumping rates are 200 and 300 lpm. Commercially available components were specified. The effect of pump speed, fluid viscosity, and vapor pressure on flowrate was determined. GRA

N78-16498# Ohio State Univ. Research Foundation, Columbus.
APPLICATION OF FOURIER TRANSFORM SPECTROSCOPY TO AIR POLLUTION PROBLEMS Interim Report
J. G. Calvert, W. H. Chan, E. Niple, R. J. Nordstrom, and J. H. Shaw Aug. 1977 115 p refs
(Grant EPA-R-803868-1)
(PB-272891/3; EPA-600/3-77-025) Avail: NTIS HC A06/MF A01 CSCL 04A

Spectra of air samples at ground level of approximately 10m, 100m, and 1km, and solar spectra obtained for solar zenith distances between 40 and 87 degrees were obtained. Examples of these spectra in the region from 1100 to 1200/cm are presented together with spectra calculated from the atmospheric line parameter listing. From the absorption features of fluorocarbon-12 near 1160/cm in solar spectra, a mean tropospheric abundance of 0.34 ppb was estimated. A photochemical cell capable of approximating the solar noon irradiance at ground level between 300 and 400nm and in which path lengths in excess of 200m can be obtained is described. GRA

N78-16499# Bureau of Mines, College Park, Md. Metallurgy Research Center.
METALS IN THE COMBUSTIBLE FRACTION OF MUNICIPAL SOLID WASTE
Benjamin W. Haynes, Stephen L. Law, and William J. Campbell 1977 22 p refs
(PB-272946/5; BM-RI-8244) Avail: NTIS HC A02/MF A01 CSCL 13B

The combustible fraction of urban refuse is being extensively considered as a fuel supplement for coal in the generation of heat and power. The objective of these analytical studies was to determine the concentration of major, minor, and trace elements in the combustible fractions collected at various locations in the urban refuse recycling pilot plant located at College Park, Md. The samples processed through the plant were submitted by varioRs municipalities that are considering resource recovery as an alternative to landfill or other means of disposal. GRA

N78-16500# Engineering-Science, Inc., McLean, Va.
AN INVESTIGATION OF THE EFFECT OF THE TEMPORAL AND SPATIAL VARIATION OF HYDROCARBON EMISSIONS UPON HYDROCARBON CONCENTRATIONS Final Report
Apr. 1977 48 p
(Contract EQ7AD189)
(PB-273297/2; EQ-517714189) Avail: NTIS HC A03/MF A01 CSCL 13B

The current strategy for attainment of oxidant standards assumes that oxidant levels are directly related to hydrocarbon emissions w/o regard to their spatial or temporal distribution. Roll back models were applied to metropolitan emissions and the required percent reductions in emissions calculated. An estimate was made of the change in reduction of emissions that would be required if the spatial and temporal distributions were considered. Several hypothetical distributions were examined which would represent a cross section of emission conditions for cities having heavy industrial sectors, suburban traffic problems, etc. A special study was done for Washington, D.C., to find out what the difference might be when a cell by cell inventory was compared to an inventory which was developed using the present assumption of uniformity of emissions. GRA

N78-16501# Utah Water Research Lab., Logan.
PERFORMANCE EVALUATION OF AN EXISTING SEVEN CELL LAGOON SYSTEM Final Report, 1974 - 1976
James H. Reynolds, Ralph E. Swiss, Christine A. Macko, and E. Joe Middlebrooks Aug. 1977 188 p refs
(Contract EPA-68-03-2060)
(PB-273533/0; EPA-600/2-77-086) Avail: NTIS HC A09/MF A01 CSCL 13B

Yearly performance of a seven cell facultative wastewater lagoon system was compared with existing state and federal discharge standards and with the criteria used to design the lagoon system to evaluate existing design equations. Twenty-four hour composite samples or grab samples for certain analyses were collected for four 30 consecutive day periods (once each season) and twice a week in the periods between for 13 months and tested for chemical and physical parameters. Results are discussed in relation to discharge standards and design of lagoon systems. GRA

N78-16502# Monsanto Research Corp., Dayton, Ohio.
METHODOLOGY AND INSTRUMENTATION TO MEASURE GASEOUS AMMONIA Final Report
D. J. David, M. C. Willson, and D. S. Ruffin Aug. 1977 118 p refs
(PB-273018/2; EPA-600/2-77-125) Avail: NTIS HC A06/MF A01 CSCL 14B

Methodology for the time integrated collection and analysis of atmospheric ammonia makes use of optical wave guides which are 1 x 20 mm quartz rods coated with a chemical that is specific for NH3. As ammonia reacts with the chemical on the rod, the optical properties of light passing through the rod change and can be directly related to the NH3 concentration. An optical wave guide analyzer was developed to measure the resulting change in optical properties. Concentrations as low as 1 ppb can be assayed. The coated quartz rods are placed in the field

for 24 hours and brought back to the laboratory for analysis by the analyzer. GRA

N78-16503# Forest Service, Washington, D. C.
NON-POINT WATER QUALITY MODELING IN WILDLAND MANAGEMENT: A STATE-OF-THE-ART ASSESSMENT. VOLUME 2: APPENDIXES Final Report
Jul. 1977 577 p
(Contract EPA-IAG-D5-0660)
(PB-272949/9; EPA-600/3-77-078-Vol-2) Avail: NTIS HC A25/MF A01 CSCL 02F

Model evaluation forms and watershed inventory forms are compiled as basis for the conclusions reached in the state-of-the-art assessment presented in Volume 1. Wildland management activities are related to an inventory of monitored watersheds having data suitable for model development and testing. GRA

N78-16504# Rutgers - The State Univ., New Brunswick, N. J. Water Resources Research Inst.
ATMOSPHERIC REAERATION IN A LAKE
Shaw L. Yu, Thomas J. Tuffey, and Drun-Sun Lee Aug. 1977 60 p refs
(Contract DI-14-31-0001-5031)
(PB-273849/0; W78-00561; OWRT-A-041-NJ(1)) Avail: NTIS HC A04/MF A01 CSCL 13B

Mass transfer and boundary layer theories were utilized to formulate a functional relationship between the reaeration coefficient and pertinent physical parameters. Field work was carried out in Spruce Run Reservoir to obtain actual measurements of these parameters. Correlation analysis was then performed to yield several besfit equations. Wind speeds were measured at three different heights above the surface level of the water within the plastic-lined circular pools, which were the apparatus adopted for experimentation. Results show that wind speed was a limiting factor affecting reaeration in a lake. GRA

N78-16505# General Accounting Office, Washington, D. C. Community and Economic Development Div.
IMPROVEMENT NEEDED BY THE WATER RESOURCES COUNCIL AND RIVER BASIN COMMISSIONS TO ACHIEVE THE OBJECTIVES OF THE WATER RESOURCES PLANNING ACT OF 1965
31 Oct. 1977 17 p
(PB-273552/0; CED-78-1) Avail: NTIS HC A02/MF A01 CSCL 13B

The study concentrates on the Council's responsibilities to review plans submitted by river basin commissions. It was further stated that the Council and the river basin commissions have made only limited progress in achieving these responsibilities and that they need to further define and implement (1) the planning and coordination goals of the Council and the river basin commissions, (2) the means for accomplishing these goals, and (3) the role of the Council and the river basin commissions in attaining these goals. GRA

N78-16506# National Wildlife Federation, Washington, D.C.
NATIONAL WILDLIFE FEDERATION INTERIM SURVEY OF EPA 201 WASTEWATER TREATMENT FACILITY GRANT PROGRAM DOCUMENTS: LAND USE IMPACTS, NEPA COMPLIANCE, AND PUBLIC PARTICIPATION, 1 JANUARY - 31 MARCH 1976 Final Report
John M. Lishman and Thomas K. Bick 15 Sep. 1977 244 p refs
(Contracts EQ6AD357; EQ7AD145)
(PB-273640/3) Avail: NTIS HC A11/MF A01 CSCL 13B

A four part analysis was made of EPA performance, region by region, reland use impacts, compliance with legal requirements, and public participation in the 201 wastewater treatment facility grants program. GRA

N78-16507# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
AEROS MANUAL SERIES. VOLUME 3: SUMMARY AND RETRIEVAL, SECOND EDITION Final Report
Jul. 1977 624 p
(PB-273908/4; EPA-450/2-76-009a-Vol-3; OAQPS-1.2-040A-Vol-3) Avail: NTIS HC A99/MF A01 CSCL 13B

The Aerometric and Emissions Reporting System (AEROS) Summary and Retrieval Manual, Volume III of the Office of Air Quality Planning and Standards Guidelines Manual Series, describes and illustrates the reporting and analysis capabilities of the various AEROS systems. It also describes the analysis packages available for use in the evaluation of AEROS data and describes the user access procedures for obtaining AEROS.reports. It describes the standard publications available from the National Aerometric Data Bank to provide quarterly or annual information on emissions and air quality. In an application section, the manual provides specific examples of applications of AEROS data. It also gives an overview of the Comprehensive Data Handling System which is an AEROS related system for storing and reporting air quality and emissions data. Author (GRA)

N78-16508# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
SATELLITE REMOTE SENSING STUDY OF THE TRANS-BOUNDARY MOVEMENT OF POLLUTANTS Final Report
C. T. Wezernak and D. R. Lyzenga May 1977 28 p refs
(Grant EPA-R-803671)
(PB-274069/4; ERIM-115100-2-F; EPA-600/3-77-056) Avail: NTIS HC A03/MF A01 CSCL 13B

A limit analysis of ERTS (LANDSAT) data of the western basin of Lake Erie and the southern portion of Lake Huron was performed. The ERTS (LANDSAT) data, as recorded on computer compatible tapes, were processed to display surface circulation features, surface suspended solids distribution, surface chlorophyll distribution, and secchi disc transparency. The results demonstrate the potential of satellite remote sensing for monitoring of large water bodies. GRA

N78-16509# National Bureau of Standards, Washington, D. C.
SIMULATED PRECIPITATION REFERENCE MATERIALS, 2 Final Report
John K. Taylor, E. R. Deardorff, and T. F. Rains Sep. 1977 27 p
(Contract EPA-IAG-D-7F1069)
(PB-273945/6; NBSIR-77-1315) Avail: NTIS HC A03/MF A01 CSCL 07D

A series of reference materials were prepared for chemical analysis of natural precipitation. These reference materials will be distributed by the Environmental Protection Agency as a means to intercalibrate atmospheric monitoring stations. The materials consist of ampoules of concentrates which can be diluted to simulate natural rainwater. A separate reference sample to be used undiluted, is provided for evaluating acidity measurements. The analytic measurements made to establish the composition of the samples are also described. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N78-16510 Pennsylvania State Univ., University Park.
A QUANTITATIVE METHOD FOR THE DETECTION OF INDIVIDUAL SUBMICRON SULFATE PARTICLES Ph.D. Thesis
Yaacov Mamane 1977 152 p
Avail: Univ. Microfilms Order No. 77-23253

The method is based on the reaction of the sulfate ion with barium chloride and can be applied only to soluble sulfates. The result of the reaction is a characteristic halo easily recognized under the electron microscope. In addition, this method yields the size distribution of submicron sulfate particles. The method is specific for sulfates. Soluble carbonates, nitrates and sulfites do not cause interference. It enables one to distinguish between ammonium sulfate and sulfuric acid particles and provides some information on mixed sulfates. The method has been applied to samples of atmospheric aerosols representing very different environments' a power plant plume, rural area, and southwestern U.S. urban location. Dissert. Abstr.

N78-16511 Pennsylvania State Univ., University Park.
MULTIVARIATE ANALYSIS OF PETROGRAPHIC AND CHEMICAL DATA FROM THE ALDRIDGE FORMATION, SOUTHERN PURCELL MOUNTAIN RANGE BRITISH COLUMBIA, CANADA Ph.D. Thesis
Frederick Robin Edmunds 1977 385 p
Avail: Univ. Microfilms Order No. 77-23228

The need for simple basic information on the formation as a whole concerning the nature of its component lithologies and the manner in which the common geologic variables interact in response to various geologic processes are is reviewed. The techniques of statistics, in particular multivariate analysis using principal components, were selected as the most suitable to achieve these objectives. The samples were subjected to petrographic and chemical analysis to provide 32 textural, mineral, oxide, and trace element variables. Univariate analysis involving the modelling and fitting of distribution functions rejected the null hypothesis that a homogeneous population with specified distribution had been sampled at random. Cluster analysis using the variance-covariance matrices and factor analysis identified two subpopulations (rock types). The two rock types are High Rank Greywacke and Argillite. Dissert. Abstr.

N78-16512 Columbia Univ., New York.
THERMAL HISTORY OF THE NORWEGIAN-GREENLAND SEA AND ITS RIFTED CONTINENTAL MARGIN Ph.D. Thesis
Gary William Zielinski 1977 166 p
Avail: Univ. Microfilms Order No. 77-24137

Based on heat flow alone it is difficult to say whether or not a regional thermal anomaly exists beneath the entire Norwegian-Greenland Sea. To pursue this question, a new computer model of seafloor spreading has been developed. This time-dependent thermal model simulates not only the evolution of the oceanic region, but also the thermal evolution of an Atlantic-type continental margin. Incorporation of the adjacent continent into a seafloor spreading model allows one to utilize geological and geophysical data from the continent and continental margin as additional constraints. A more complete picture of the early spreading history and its relation to the initial rifting of the continent is provided. While vertical heat flow dominates in both the ocean and continent proper, several effects of lateral heat flow across the ocean continent boundary are seen.
Dissert. Abstr.

N78-16513 California Univ., Los Angeles.
THE USE OF SEISMOTECTONICS IN THE BAYESIAN ESTIMATION OF SEISMIC RISK Ph.D. Thesis
Kenneth Walter Campbell 1977 177 p
Avail: Univ. Microfilms Order No. 77-23845

In areas where there exists a clear relationship between tectonics and earthquake occurrences, the use of both seismotectonic data and local historic seismicity is expected to provide the best possible overall picture of seismic risk. Bayesian probability theory provides a rigorous mathematical basis for including these diverse types of information in the estimation of seismic risk, defined as the probability that the largest earthquake magnitude occurring in a given period of time will exceed a specified value. Besides the rigorous distribution, three mathematically simpler Bayesian models of seismic risk are developed and evaluated. One distribution in particular, known as the Substitutive model, is found to give results similar to the rigorous model over a wide range of parameters. Dissert. Abstr.

N78-16514 Brandeis Univ., Waltham, Mass.
GRAVITATIONAL MODELS WITH HIGHER DERIVATIVES Ph.D. Thesis
Kellogg Sheffield Stelle 1977 96 p
Avail: Univ. Microfilms Order No. 77-22837

A class of gravitational models derived from actions which contain both the Hilbert action and two additional terms quadratic in the curvature tensor are considered at the classical and quantum mechanical levels. In addition to the usual massless excitations of the field, these models contain massive spin two and massive scalar excitations, with masses dependent upon the ratios of the coefficients of the new terms in the action to that of the Hilbert term. Specific combinations of the new terms give models with either the massive tensor or massive scalar absent. The models achieve for the first time renormalizability in a gravitational model, but at the price of either negative probabilities, a loss of unitarity, or possibly a loss of microscopic casualty. Dissert. Abstr.

N78-16515 Stanford Univ., Calif.
THE DETERMINATION OF FAULT MODELS FROM GEODETIC DATA Ph.D. Thesis
William Scott Dunbar 1977 233 p
Avail: Univ. Microfilms Order No. 77-25658

Large scale features of the seismic cycle as observed by means of geodetic data are discussed. The basic equations of dislocation theory are derived. Methods of modelling faults either as a specified dislocation or as a stress release over a rectangular region in an elastic halfspace are presented. Different types of boundary conditions may be placed on the fault surface, affording the possibility of modelling faults quite realistically. Equations relating the stress release to the amount of fault slip are used as a means of determining geometrical constants for the estimation of stress drops on finite rectangular faults. Least squares is proposed as a method of determining the amount of slip on a dislocation model required to satisfy observed geodetic data.
Dissert. Abstr.

N78-16516 Wyoming Univ., Laramie.
ATMOSPHERIC MEASUREMENTS OF NITRIC OXIDE USING A CHEMILUMINESCENT DETECTOR Ph.D. Thesis
John Wendell Drummond 1977 109 p
Avail: Univ. Microfilms Order No. 77-26603

A chemilumunescent nitric oxide (NO) detector with sensitivity of .02 ppbv at 10% above the zero noise level was developed to measure NO both at ground level and in the stratosphere. Two balloon flights were made to obtain vertical profile measurements for NO in conjunction with ozone and temperature. The first flight was made from Laramie, Wyoming, and ascended to an altitude of 30 km. Data were taken from 1024 to 1142 local sun time and gave a constant NO concentration of 1 x 10 to the 8th power 1/cu cm to 25 km and then began to increase to 5 x 10 to the 8th power 1/cu cm at 30 km. The second flight from Sioux Falls, South Dakota, reached an altitude of 45 km. The data were taken on ascent from 0536 to 0748 LST and showed approximately constant NO concentration of 5 x 10 to the 8th power 1/cu cm to 40 km and then nearly a constant mixing ratio of 7 ppbv to 45 km, with a possible broad peak at 42 km. Dissert. Abstr.

N78-16517 Illinois Univ., Urbana-Champaign.
AN INCOHERENT SCATTER INVESTIGATION OF THE PROPERTIES OF INTERNAL GRAVITY WAVES IN THE IONOSPHERIC F-REGION Ph.D. Thesis
Allen Lee Hearn 1977 178 p
Avail: Univ. Microfilms Order No. 77-26675

Fluctuations of the F-region electron density in the gravity wave period range are monitored using the Arecibo incoherent scatter radar. The radar is pointed in the vertical direction and a transmitted pulse of 50 microns in length is used to provide one minute time resolution time series of 4 to 30 hours duration at several altitudes in the altitudes range of 197.85 km to 485.85 km. Segments of these records with a duration of approximately 4 hours are spectral analyzed using the technique of maximum entropy power spectral analysis. Seen in several sets of these power spectra are two dips in the power level one of which is shown to be consistent with the large attenuation of gravity waves anticipated near the Brunt-Vaisala frequency. The second dip which is strongly altitude dependent is associated with the no response condition when the gravity wave vector is perpendicular to the earth's magnetic field lines. Dissert. Abstr.

N78-16518 State Univ. of New York, Stony Brook.
NATURAL PERIDOTITES: CHEMICAL AND RHEOLOGICAL HETEROGENEITY OF THE UPPER MANTLE Ph.D. Thesis
Jean-Claude Christian Mercier 1977 700 p
Avail: Univ. Microfilms Order No. 77-27474

The physical, chemical, petrological and textural nature of the upper mantle to depths of about 250 km beneath the continents and 120 km beneath the oceans was investigated on the basis of data collected from more than 150 ultramafic suites. The techniques used included a single-pyroxene technique

by which pressure and temperature estimates were derived independently from a single pyroxene analysis. Columnar sections and profiles were obtained illustrating the vertical petrological, chemical, structural, textural and physical characteristics of the upper mantle. These sections indicate the occasional presence of cumulates at particular depths and illustrate the worldwide existence of smooth vertical variations throughout the metamorphic mantle as a result of large scale partial melting and metasomatism. Dissert. Abstr.

N78-16519 Colorado Univ., Boulder.
GLOBAL SEA LEVEL CHANGES SINCE THE LAST GLACIAL MAXIMUM AND SEA LEVEL CONSTRAINTS ON THE ICE SHEET DISINTEGRATION HISTORY Ph.D. Thesis
James Alan Clark 1977 164 p
Avail: Univ. Microfilms Order No. 77-29902

Sea level has changed dramatically since the last glacial maximum (16,000 to 20,000 years ago) with a rise in sea level since that time of approximately 100 meters in many parts of the world. The main causes are the filling oceans with meltwater from changing ice and water loads. These effects, as well as change in the earth's gravitational equipotential surface (the geoid) defining the ocean surface, are considered in a numerical model of sea level changes during the past 16,000 years. Results indicate that the earth can be divided into six zones with each zone encompassing a characteristic sea level response. In four of these zones a raised beach is predicted to occur whereas the remaining zones have experienced continual submergence. Observations support the changing sea level model with the notable exception of localities very close to the ice sheets. Dissert. Abstr.

N78-16520*# Stanford Univ., Calif. Dept. of Physics.
POST-NEWTONIAN GRAVITATIONAL BREMSSTRAHLUNG
Michael Turner and Clifford M. Will Jul. 1977 28 p refs
(Grants NsG-7204; NSF PHY-76-21454)
(NASA-CR-155578; SU-ITP-580) Avail: NTIS HC A03/MF A01 CSCL 08N

Formulae and numerical results are presented for the gravitational radiation emitted during a low-deflection encounter between two massive bodies. Results are valid through post-Newtonian order within general relativity. The gravitational waveform, the total luminosity and total emitted energy, the angular distribution of emitted energy, and the frequency spectrum are discussed in detail. A method boosting the accuracy of these quantities to post Newtonian order is also presented. A numerical comparison of results with those of Peters, and of Kovacs and Thorne shows that the post Newtonian method is reliable to better than 0.1 percent at v = 0.1 c, to a few percent at v = 0.35 c, and to 10 to 20 percent at v = 0.5 c. Author

N78-16521*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ABSOLUTE RATE OF THE REACTION OF BROMINE ATOMS WITH OZONE FROM 200-360 K
J. V. Michael, J. H. Lee, W. A. Payne, and L. J. Stief Jan. 1978 22 p refs Submitted for publication
(NASA-TM-78061) Avail: NTIS HC A02/MF A01 CSCL 04A

The rate constant for the reaction Br + O3 yields BrO + O2 was measured from 200 to 360 K by the technique of flash photolysis coupled to time resolved detection of bromine atoms by resonance fluorescence (FP-RF). Br atoms were produced by the flash photolysis of CH3Br at lambda > 165nm.[O3] was monitored continuously under reaction conditions by absorption at 253.7 nm. At each of five temperatures the results were independent of substantial variations in [O3], total pressure and limited variations in flash intensity. The measured rate constants obeyed the Arrhenius expression, where the error quoted is two standard deviations. Results are compared with previous determinations which employed the discharge flow-mass spectrometric technique. Author

N78-16522*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
GRAVITATION
A. J. Fennelly Jan. 1978 46 p refs
(NASA-TM-78151) Avail: NTIS HC A03/MF A01 CSCL 08N

Investigations of several problems of gravitation are discussed. The question of the existence of black holes is considered. While black holes like those in Einstein's theory may not exist in other gravity theories, trapped surfaces implying such black holes certainly do. The theories include those of Brans-Dicke, Lightman-Lee, Rosen, and Yang. A similar two-tensor theory of Yilmaz is investigated and found inconsistent and nonviable. The Newman-Penrose formalism for Riemannian geometries is adapted to general gravity theories and used to implement a search for twisting solutions of the gravity theories for empty and nonempty spaces. The method can be used to find the gravitational fields for all viable gravity theories. The rotating solutions are of particular importance for strong field interpretation of the Stanford/Marshall gyroscope experiment. Inhomogeneous cosmologies are examined in Einstein's theory as generalizations of homogeneous ones by raising the dimension of the invariance groups by one more parameter. The nine Bianchi classifications are extended to Rosen's theory of gravity for homogeneous cosmological models. Author

N78-16523*# Illinois Univ., Urbana. Aeronomy Lab.
RESEARCH IN AERONOMY Progress Report, 1 Oct. 1976 - 31 Mar. 1977
Belva Edwards, ed. Mar. 1977 161 p refs
(Grants NGR-14-005-181; NSF ATM-73-06485; NSF ATM-75-15523; NSF ATM-76-01773)
(NASA-CR-155587; PR-77-1) Avail: NTIS HC A08/MF A01 CSCL 04A

Topics discussed include: ionospheric chemistry and dynamics; radio propagation experiments using Nike Tomahawk missiles; meteor-radar observations of wind; incoherent scattering; analytical and numerical methods for plasma diagnostics; electrodynamics; and planetary wave propagation. A.R.H.

N78-16524*# Arizona State Univ., Tempe.
VOLCANISM OF THE EASTERN SNAKE RIVER PLAIN, IDAHO: A COMPARATIVE PLANETARY GEOLOGY GUIDEBOOK
Ronald Greeley and John S. King Aug. 1977 303 p refs
Prepared in cooperation with State Univ. of New York, Buffalo
(NASA-CR-154621) Avail: NTIS HC A14/MF A01 CSCL 08G

The Planetary Geology Field Conference on the central Snake River Plain was conceived and developed to accomplish several objectives. Primarily, field conferences are sponsored by the National Aeronautics and Space Administration to draw attention to aspects of terrestrial geology that appear to be important in interpreting the origin and evolution of extraterrestrial planetary surfaces. Another aspect is to present results of recent research in a region. A final objective of this conference is to bring together investigators of diverse backgrounds who share a common interest in the Snake River Plain. The Snake River Plain appears to be similar in surface morphology to many volcanic regions on the Moon, Mars, and possibly Mercury. Therefore, the Snake River Plain, in combination with the relatively good state of preservation, the lack of forests or other heavy vegetation, and the good network of jeep trails, is an area nearly ideal for analog studies. Author

N78-16525*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ABSOLUTE CALIBRATION IN THE 1750 - 3350 A REGION
George J. Strongylis and Ralph C. Bohlin Sep. 1977 26 p refs Submitted for publication
(NASA-TM-78035) Avail: NTIS HC A03/MF A01 CSCL 04A

The absolute flux measurements in the rocket ultraviolet made by Bohlin, Frimout, and Lillie (BFL) are revised using a more correct treatment of the air extinction that enters the air calibration of their instrument. The absorption by molecular oxygen and ozone, Rayleigh scattering, and extinction by aerosols is tabulated for general use in ultraviolet calibrations performed in air. The revised absolute flux of eta UMa and final fluxes for alpha Lyr and zeta Oph are presented in the 1750-3350 A region. The absolute flux of the star eta UMa is compared to four other independent determinations in the 1200-3400 A region and a maximum difference of 35% is found near 1500 A between the OAO-2 and Apollo 17 fluxes. The rocket measurements of BFL, the ANS and TD-1 satellite data, and the Apollo 17 data are

compared to the ultraviolet fluxes from the OAO-2, demonstrating a photometric reproducibility of about + or - 3 percent. Therefore, all four sets of spectrophotometry can be reduced to a common absolute scale. Author

N78-16526# Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
INTERMITTENT ICE FORCES ACTING ON INCLINED WEDGES
Per Tryde Oct. 1977 35 p refs Sponsored by the Army
(AD-A046590; CRREL-77-26) Avail: NTIS HC A03/MF A01 CSCL 20/11

A theory for ice forces acting on inclined wedges has been developed, thus making it possible to predict the magnitude of the intermittent ice forces from knowledge of the physical parameters of the system. The theory has been verified by model tests with artificial and natural ice. Author (GRA)

N78-16527# Naval Postgraduate School, Monterey, Calif.
DIVERGENT INITIALIZATION, EXPERIMENTS USING A GLOBAL PRIMITIVE, EQUATION SPECTRAL MODEL M.S. Thesis
Olaf Martin Lubeck Jun. 1977 77 p refs
(AD-A047122) Avail: NTIS HC A05/MF A01 CSCL 04/2

An initialization of a spectral formulation of the primitive equations using a diagnostic divergence is tested for a global model. The initial conditions are generated from a developing baroclinically unstable wave. A semi-implicit time scheme is developed and tested along with the usual explicit method during the course of the experiments. Results show a relatively small effect of a divergent initialization on the ensuing integrations. The semi-implicit method shows a tendency to smooth out high frequency oscillations in local tendencies. Author (GRA)

N78-16528# Naval Postgraduate School, Monterey, Calif.
THE OPERATIONAL DETERMINATION OF WIND STRESS ON THE ARCTIC ICE PACK
Larry Dennis Ashim Sep. 1977 81 p refs
(AD-A047319) Avail: NTIS HC A05/MF A01 CSCL 08/12

The performance of routine FNWC sea level pressure analyses and forecasts in the Beaufort Sea is evaluated for driving an ice model. The geostrophic winds determined from the FNWC pressure fields are compared to geostrophic winds determined from the AIDJEX experiment observations. A simulation with the AIDJEX model has been run using FNWC sea level pressure analysis fields for the period 15 to 25 May 1975 and compared to the AIDJEX results. RMS sea level pressure errors of about 3 mb were found with analysis errors reduced by about 1 mb when one AIDJEX observation was included in the analysis. Geostrophic winds had speed differences of about 40% and direction differences of about 50 deg. The FNWC simulation with the AIDJEX model produced a position error of about 7 km for one station over the ten day run. Recommendations are made to improve the FNWC hemispheric fields in the Arctic for application to ice forecasting. Author (GRA)

N78-16529# Colorado School of Mines, Golden. Dept. of Geophysics.
BEHAVIOR OF ELECTRIC POTENTIAL FIELDS OVER RANDOMLY LAYERED EARTH MODELS Ph.D. Thesis
Chong Yang Lee 19 Apr. 1977 122 p refs
(Contract N00014-76-C-0750)
(AD-A046975; T-1950) Avail: NTIS HC A06/MF A01 CSCL 08/7

Solutions are derived for the potential distributions over one-layer and two-layer random conductivity earth models for the direct current resistivity method. The random potential due to a stationary Gaussian random conductivity function is non-Gaussian and non-stationary. The ensemble and sample statistics of the random potential fields are examined. The potential field due to dipole excitation is more sensitive to variations in conductivity in the subsurface than that due to monopole excitation. Random variations in conductivity at depth are difficult to detect. Representative curves of the apparent resistivity and kernel functions are presented to show the effects of a random conductivity profile on them. These effects are appreciable and result in significant errors in the interpretation of resistivity data. However, noise of this kind is difficult to distinguish from the signal itself, especially in the presence of measurement noise. Nevertheless, variations in the conductivity profile should be recognized as an additional source of error in the interpretation of resistivity data. Author (GRA)

N78-16530# Texas Instruments, Inc., Dallas. Equipment Group.
VELA NETWORK EVALUATION AND AUTOMATIC PROCESSING RESEARCH Quarterly Report, 1 Jul. - 30 Sep. 1977
Robert L. Sax 3 Oct. 1977 23 p
(Contract F08606-77-C-0004)
(AD-A047310; TI-ALEX(01)-QR-77-04; QR-4) Avail: NTIS HC A02/MF A01 CSCL 08/11

This quarterly report summarizes progress under the VELA Network and Automatic Processing Research program in the following areas: Evaluation of the Iranian Long Period Array (ILPA) and the Seismic Research Observatories (SRO) data; Development of detection methods; Methods of extracting long-period event waveforms; Interactive seismic; signal processing; Determining path corrections, and extracting source parameters from long-period data. GRA

N78-16531# Rome Air Development Center, Griffiss AFB, N.Y.
VLF/LF REFLECTIVITY OF THE POLAR IONOSPHERE, 2 JANUARY - 30 APRIL 1977
John E. Rasmussen, John P. Turtle, Robert P. Pagliarulo, and Wayne I. Klemetti Jul. 1977 70 p refs
(AD-A047238; RADC-TR-77-251) Avail: NTIS HC A04/MF A01 CSCL 20/14

This report provides a summary of high latitude ionospheric reflectivity as observed by the USAF high resolution VLF/LF ionosounder operating in northern Greenland. Ionospheric reflectivity parameters, including reflection heights and coefficients, are presented as a function of time of day. VLF long path propagation measurements, along with magnetometer and riometer data, are presented as supplementary information. Author (GRA)

N78-16532# Ford Motor Co., Dearborn, Mich.
THE KINETICS OF THE GAS PHASE REACTION OF NITROUS ACID WITH OZONE Final Report
E. W. Kaiser and S. M. Japar Jul. 1977 23 p refs
(Contract DOT-TSC-1201)
(AD-A046159; FAA-AEQ-77-7) Avail: NTIS HC A02/MF A01 CSCL 04/1

The kinetics of the gas phase reaction between ozone and nitrous acid have been investigated under conditions applicable to the middle stratosphere. The decay of nitrous acid (-0.005 Torr) in the presence of excess ozone (0.4-14 Torr) has been measured at 226 and 300 K using a mass spectrometer detector. At both temperatures, the observed decay rate is independent of ozone concentration and apparently arises from heterogeneous reactions, rather than from the homogeneous bimolecular reaction, HNO2 + O3 yields HNO3 + O2. Conservative upper limits to the value of Reaction coefficient, calculated by assuming that the entire HNO2 decay results from this reaction, are from 1 to 5 times 10 to the -19 power cu.cm molecule/sec at 300 and 226 K respectively. Calculations based on a simplified mechanism for stratospheric NOx chemistry indicate that reaction, with a rate constant of the magnitude reported above, is unlikely to be important in the chemistry of the stratosphere. Author (GRA)

N78-16533# Naval Surface Weapons Center, Dahlgren, Va.
SOLID EARTH TIDES IN THE EQUATIONS OF MOTION OF THE TERRA SYSTEM OF COMPUTER PROGRAMS FOR SATELLITE GEODESY Final Report
W. J. Groeger and R. B. Manrique Feb. 1977 23 p refs
(AD-A038933; NSWC/DL-TR-3560) Avail: NTIS HC A02/MF A01 CSCL 08/5

An algorithm is presented for the Newtonian attraction which the tidal bulge of the solid earth exerts on artificial earth satellites. The lunar component of the tide, as well as that caused by the sun, are considered. The tidal properties are assumed to be latitudinally variable, which is expressed by Love coefficients which are zonal harmonic expansions of latitude. There is a provision to allow for tidal lag. The latter manifests itself as a time delay in the response of the tidal mass redistribution to the tidal stress

field. Its origin are the elasticity and plasticity of the earth and the inertia of the masses involved. Author (GRA)

N78-16534# Belgian Royal Observatory, Brussels.
TRANS WORLD TIDAL GRAVITY PROFILE Interim Scientific Report, 1 Jun. 1973 - 30 Sep. 1976
P. Melchior Dec. 1976 20 p refs
(Grant AF-AFOSR-2557-73)
(AD-A037835; AFGL-TR-77-0037; IR-3) Avail: NTIS HC A02/MF A01 CSCL 08/5

Tidal gravity profiles were established in Australia and Papua, New Guinea, commencing September 1974. Five stations were occupied in all using four tidal gravimeters. Data were analyzed and the results obtained are presented. The gravimeters were calibrated at the fundamental station established at Canberra. Uniformity is maintained with the Brussels fundamental station. It is assessed that the normalization coefficients for each instrument are correct to about 0.5% for the diurnal waves and about 1% for M2. GRA

N78-16535# Virginia Univ., Charlottesville. Dept. of Engineering Science and Systems.
DEVELOPMENT OF FINITE ELEMENT MODELS FOR THE EARTH'S GRAVITY FIELD. PHASE 2: FINE STRUCTURE DISTURBANCE GRAVITY REPRESENTATIONS Final Report
John L. Junkins and John T. Saunders Feb. 1977 108 p
(Contract DAAG53-76-C-0067)
(AD-A038468; UVA/525023/ESS77/104; ETL-0097) Avail: NTIS HC A06/MF A01 CSCL 08/5

This report develops locally valid Chebyshev polynomial representations of gravitational disturbance accelerations to use, for example, in inertial guidance calculations. The gravity field can be accurately represented in this fashion, the computational speed is increased by about a factor of twenty in comparison to point mass representations. Author (GRA)

N78-16536# California Univ., Berkeley. Earthquake Engineering Research Center.
EARTHQUAKE ENGINEERING RESEARCH AT BERKELEY, 1976
May 1977 198 p refs Presented at the 6th World Conf. on Earthquake Eng., New Delhi, 10-14 Jan. 1977 Sponsored in part by NSF, NBS, and the Alyeska Pipeline Service Co.
(PB-273507/4; UCB/EERC-77/11) Avail: NTIS HC A09/MF A01 CSCL 13L

Various seismic effects of earthquakes and ground movements are delineated, emphasizing risks in urban areas and computer analyses. Seismic design implications for reinforced concrete, R/C interior frame joints, and nuclear facilities are also considered. M.V.

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N78-16537 Nevada Univ., Reno.
A COMPARATIVE STUDY OF CUMULUS CLOUD MODELS Ph.D. Thesis
James Sakaria Kalathil 1977 254 p
Avail: Univ. Microfilms Order No. 77-25081

The interrelationship among scientific theories, models and analogies is illustrated by using models for the different stages in the evolution of a cumulus cloud, and criteria are developed for a comprehensive cumulus cloud model. The necessary background for cloud models is established and some of the recent cumulus models are then categorized and analyzed on the basis of the dimensionality of the equations employed, the dynamical processes of entrainment, updraft-downdraft interaction, and the extent of microphysical processes included in the model. The models are also compared against the criteria for a comprehensive cumulus model. It is found that only a few of the models compared seem to adequately satisfy these criteria. Numerical tests were conducted on a one-dimensional model to determine the sensitivity of the model to the dynamical and microphysical parameters employed in the model. Dissert. Abstr.

N78-16538 Utah Univ., Salt Lake City.
CLOUD COMPOSITION DETERMINATION BY SATELLITE SENSING USING THE NIMBUS 6 HIGH RESOLUTION INFRARED SOUNDER Ph.D. Thesis
Robert George Feddes 1977 213 p
Avail: Univ. Microfilms Order No. 77-24176

The radiative properties of clouds in the HIRS channels are investigated using the discrete ordinate method for approximating the solution of the radiative transfer equation as it is applied to non-isothermal, inhomogeneous cloudy atmospheres. Analysis of the upwelling radiances from the model in the presence of clouds indicates that cirrus clouds decrease the upwelling radiance more than middle clouds and that multilayered middle and cirrus clouds are indistinguishable from thick cirrus clouds. The results of the theoretical calculations are parameterized and an empirical method to determine cloud type and ice and water content of the clouds is described. Extension of the parameterizations in an overcast field of view to a partly cloudy atmosphere is described. Combining this technique with microwave and broad band radiometer parameterizations to increase the accuracy of cloud composition determinations is discussed. Dissert. Abstr.

N78-16539 Pennsylvania State Univ., University Park.
THE MUTUAL RESPONSE OF THE TROPICAL CYCLONE AND THE OCEAN AS REVEALED BY AN INTERACTING ATMOSPHERIC AND OCEANIC MODEL Ph.D. Thesis
Simon Wei-Jen Chang 1977 210 p
Avail: Univ. Microfilms Order No. 77-23218

A coupled axisymmetric hurricane-ocean model was used to investigate the mutual interactions between a mature, stationary hurricane and the ocean. The interactions caused adjustments of the hurricane boundary layer, which led to slow weakening of the storm, and mixing and upwelling in the ocean, which resulted in a cooling of several degrees. The feedbacks between the ocean and hurricane were negative, the weakening of the hurricane resulted in a lessened response of the ocean. The hurricane model contained an improved parameterization of the boundary layer. The parameterization of the boundary layer consisted of matched formulations for the surface layer and the mixed layer. A stratified, two-layer, baroclinic ocean model was developed in order to interact with the hurricane model. Entrainment between the two layers was computed based on a turbulent energy budget. Dissert. Abstr.

N78-16540 Florida State Univ., Tallahassee.
NUMERICAL SIMULATION OF A MID-TROPOSPHERIC CYCLONE Ph.D. Thesis
Frederick Harold Carr 1977 295 p
Avail: Univ. Microfilms Order No. 77-24746

An initial data set is constructed from an early stage of the mid-tropospheric cyclone. A semi-Lagrangian primitive equation model is applied to the data set to make several short range predictions. The effect of regional geography and the associated problems of data quantity and quality are discussed. Forecasts made over different domains with varying grid lengths are compared. A heating function was derived from the observed rainfall totals. Experiments using this specified heating led to more quantitatively realistic forecasts. Dissert. Abstr.

N78-16541 Nevada Univ., Reno.
A NEW DEVICE FOR STUDIES OF CLOUD CONDENSATION NUCLEI ACTIVE AT LOW SUPERSATURATIONS Ph.D. Thesis
Charles Frederick Rogers 1977 179 p
Avail: Univ. Microfilms Order No. 77-25082

Developmental work was carried out on a novel device which provides controlled conditions for the study of nucleation and growth of water droplets at supersaturations towards the lower end of the scale found in the atmosphere. The device, called the diffusion tube (DT), utilizes the difference between the diffusivities of water vapor and heat in air. The DT offers the only alternative thus far developed to thermal (or chemical) diffusion chambers for this purpose. Software support for the device is necessary, numerical solution was developed. The DT

software also includes a numerical integration program to calculate cloud droplet growth in the diffusion tube. Dissert. Abstr.

N78-16542 California Univ., Los Angeles.
NUMERICAL CALCULATIONS OF THE WIND DRIVEN CIRCULATION IN A BAROTROPIC OCEAN Ph.D. Thesis
Tan-Na Lee 1976 217 p
Avail: Univ. Microfilms Order No. 77-25336

The behavior is discussed of a simple, barotropic, wind-driven ocean when sufficient resolution is present to resolve mesoscale eddies. The vorticity equation is integrated as an initial value problem until the solutions reach either a steady state or, in the case of an ocean in which eddies can appear spontaneously as a result of shear instability, a statistically steady state. The idealized model domain is a rectangular basin, 3000 km long and 2000 km wide, which is oriented so that the long axis of the basin is parallel to the east coast of the U. S. The offshore side of the basin has a simple continental shelf and slope. The model ocean is driven by a 2 1/2 gyre pattern of steady zonal wind stress in most of the cases. Three numerical experiments with different grid resolution (20km, 40km, and 80km) were conducted.
Dissert. Abstr.

N78-16543 Michigan Univ., Ann Arbor.
MICROPHYSICAL RESPONSE OF CLOUD DROPLETS IN A FLUCTUATING UPDRAFT Ph.D. Thesis
Duane Douglas Harding 1977 152 p
Avail: Univ. Microfilms Order No. 77-26260

Computations were performed for fourteen vertical velocity patterns; each allowed a closed parcel of cloud air to undergo downward as well as upward motion. Droplet solution and curvature effects were included. A unique approach is presented in which all energy sources and sinks of a droplet may be considered. Since direct calculation of the droplet temperature is required, this new approach is termed the explicit model. It is speculated that the explicit model may enhance the growth of large driplets at greater heights. The advantage of the explicit model is that it is the first capable of computing the growth rate of droplets in the presence of more than one volatile component. Such a model is beneficial to the studies of pollution scavening and acid rain. Dissert. Abstr.

N78-16544 State Univ. of New York, Stony Brook.
THE NON-DIMENSIONAL WIND SHEAR AND LAPSE RATE OVER WATER IN AN INTERNAL BOUNDARY LAYER OF THE SEA BREEZE Ph.D. Thesis
Mark Alan Stern 1977 130 p
Avail: Univ. Microfilms Order No. 77-26404

Turbulent exchange processes in relation to atmospheric circulation, were studied over water. Data were collected from a stable platform on the fluxes of heat, mass and momentum. Measurements of the fluxes of momentum and sensible heat were made simultaneously with the gradients of velocity, temperature and dew point. Results indicate correlations between fluxes of momentum and sensible heat and mean velocity, temperature and humidity gradients. Dissert. Abstr.

N78-16545*# National Aeronautics and Space Administration, Washington, D. C.
WORLD WEATHER PROGRAM PLAN FOR FISCAL YEAR 1978
Sep. 1977 79 p
(NASA-TM-74986) Avail: NTIS HC A05/MF A01 CSCL 04B

The World Weather Program, an international effort whose goals are to understand the atmosphere and to extend the time, range and scope of weather predictions, was considered. The U. S. contribution to the World Weather Program consists of three basic components: the World Weather Watch, the Global Atmospheric Research Program, and the Systems Design and Technological Development Program. U. S. initiatives carried out by federal agencies which either support or contribute to the goals of the World Weather Program are described in this plan.
Author

N78-16546# National Aviation Facilities Experimental Center, Atlantic City, N. J.
NEW YORK CITY PILOTS AUTOMATIC TELEPHONE WEATHER ANSWERING SERVICE, PATWAS, TEST, VOLUME 1 Final Report, Jul. 1975 - Jun. 1976
Frank Staiano and Ephraim Shochet Oct. 1977 124 p refs 2 Vol.
(AD-A047247; FAA-NA-77-26-Vol-1; FAA-RD-77-80-Vol-1)
Avail: NTIS HC A06/MF A01 CSCL 04/2

An improved pilots automatic telephone weather answering service (PATWAS) was subjected to a year-long test in the New York City metropolitan area. The improvements consisted of the following: (1) user access to three route-oriented briefings, (2) an increase in the number of access lines to PATWAS, (3) more frequent updating of information, (4) the addition of special early morning recordings, (5) capability to request meteorological and aeronautical information from the Weather Message Switching Center for incorporation into the PATWAS message, (6) reduction in the time required for updating, (7) addition of more meteorological and aeronautical information to the PATWAS message, (8) new and more efficient magnetic tape equipment, (9) installation of an acoustic enclosure for PATWAS tape recording, and (10) more efficient organization of the message format. The PATWAS products, schedules, user acceptance, and the effects on the telephone briefing workload at the flight service station were tested and evaluated. Author

N78-16547# National Aviation Facilities Experimental Center, Atlantic City, N. J.
NEW YORK CITY PILOTS AUTOMATIC TELEPHONE WEATHER ANSWERING SERVICE, PATWAS, TEST, VOLUME 2 Final Report, Aug. 1975 - Jul. 1976
Frank Staiano and Ephraim Shochet Oct. 1977 322 p 2 Vol.
(AD-A047248; FAA-NA-77-21-Vol-2; FAA-RD-77-80-Vol-2)
Avail: NTIS HC A14/MF A01 CSCL 04/2
For abstract, see N78-16546.

N78-16548# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
WIND SHEAR TEST SITE UPGRADING Final Report, Apr. 1976 - Aug. 1977
D. W. Beran and Duane Haugen Aug. 1977 54 p refs
(Contract DOT-FA76WAI-622)
(AD-A047253; FAA-RD-77-124) Avail: NTIS HC A04/MF A01 CSCL 04/2

The Table Mountain field site was modified in order to test the application of remote sensing techniques to the solution of airport wind shear problems. Results Data obtained during tests of a commercial and a prototype acoustic Doppler system, a CW lidar system, and a FM-CW radar system are summarized. Winds measured over approximately five minute averaging times by the commercial Doppler system and the FM-CW radar compared well. The prototype acoustic Doppler system was operated for a much longer period to determine its potential. This particular system is limited by surface winds above 10 meters per second and its performance is degraded by other background noises such as thunder. The limiting influence of rain is not as severe as had previously been expected, but it is a serious problem for intense rainfall. Author

N78-16549*# ECON, Inc., Princeton, N. J.
ECONOMIC CONSEQUENCES OF IMPROVED TEMPERATURE FORECASTS: AN EXPERIMENT WITH THE FLORIDA CITRUS GROWERS (CONTROL GROUP RESULTS) Final Report
30 Nov. 1977 325 p
(Contract NASw-3047)
(NASA-CR-155583; Rept-77-261-1) Avail: NTIS HC A14/MF A01 CSCL 04B

A demonstration experiment is being planned to show that frost and freeze prediction improvements are possible utilizing timely Synchronous Meteorological Satellite temperature measurements and that this information can affect Florida citrus grower operations and decisions. An economic experiment was carried out which will monitor citrus growers' decisions, actions, costs and losses, and meteorological forecasts and actual weather events and will establish the economic benefits of improved temperature forecasts. A summary is given of the economic experiment, the results obtained to date, and the work which still remains to be done. Specifically, the experiment design is described in detail as are the developed data collection methodology and procedures,

sampling plan, data reduction techniques, cost and loss models, establishment of frost severity measures, data obtained from citrus growers, National Weather Service, and Federal Crop Insurance Corp., resulting protection costs and crop losses for the control group sample, extrapolation of results of control group to the Florida citrus industry and the method for normalization of these results to a normal or average frost season so that results may be compared with anticipated similar results from test group measurements. Author

N78-16550*# ECON, Inc., Princeton, N. J.
ECONOMIC CONSEQUENCES OF IMPROVED TEMPERATURE FORECASTS: AN EXPERIMENT WITH THE FLORIDA CITRUS GROWERS (CONTROL GROUP RESULTS). EXECUTIVE SUMMARY Final Report
30 Nov. 1977 19 p
(Contract NASw-3047)
(NASA-CR-155584; Rept-77-261-1) Avail: NTIS HC A02/MF A01 CSCL 04B

A demonstration experiment is being planned to show that frost and freeze prediction improvements are possible utilizing timely Synchronous Meteorological Satellite temperature measurements and that this information can affect Florida citrus grower operations and decisions so as to significantly reduce the cost for frost and freeze protection and crop losses. The design and implementation of the first phase of an economic experiment which will monitor citrus growers decisions, actions, costs and losses, and meteorological forecasts and actual weather events was carried out. The economic experiment was designed to measure the change in annual protection costs and crop losses which are the direct result of improved temperature forecasts. To estimate the benefits that may result from improved temperature forecasting capability, control and test groups were established with effective separation being accomplished temporally. The control group, utilizing current forecasting capability, was observed during the 1976-77 frost season and the results are reported. A brief overview is given of the economic experiment, the results obtained to date, and the work which still remains to be done. Author

N78-16551# Bureau of Reclamation, Denver, Colo. Div. of Atmospheric Water Resources Management.
AN OVERVIEW OF THE SKYWATER 9 CONFERENCE ON PRECIPITATION MANAGEMENT AND THE ENVIRONMENT
Sep. 1977 207 p Conf. held at Vail, Colo., Nov. 1976
(PB-273030/7) Avail: NTIS HC A10/MF A01 CSCL 04B

The Skywater 9 Conference held six workshops in order to assess results and solicit contributions for future planning in weather modification. An environmental overview noted concern for possible initiation of long-term trends, linkage with conservation activities, and information transfer in the context of a regional concept. Implications for planning of Skywater environmental studies are discussed. GRA

N78-16552# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
DIAGNOSTIC ANALYSIS OF TROPICAL CUMULONIMBUS DOWNDRAFT STRUCTURE M.S. Thesis
Maria Faus Silva Dias Jun. 1977 98 p refs Sponsored in Part by NOAA, Rockville Md.
(Grant NSF OCD-74-21678)
(PB-272956/4; AS-Paper-272) Avail: NTIS HC A05/MF A01 CSCL 04B

The evaporation in the downdraft current associated with tropical cumulonimbus clouds was studied by the use of a simple set of equations for a one dimensional flow. Ideas are used in the assumption that the air in the sub cloud layer, after the storm passage, originated in a layer of equal depth above cloud base before the storm passage. In this way, the layer averaged conditions of temperature and moisture in the sub cloud layer after the storm are obtained from the layer averaged conditions in the upper layer before the storm, using a kinematic-microphysical model in which rainfall intensities, downdraft speeds and drop sizes are parameters. GRA

N78-16553# Naval Postgraduate School, Monterey, Calif.
A NUMERICAL STUDY OF BAROTROPIC INSTABILITY OF A ZONALLY VARYING EASTERLY JET Ph.D. Thesis
Jesus Bonifacio Tupaz Jun. 1977 108 p refs
(AD-A047322) Avail: NTIS HC A06/MF A01 CSCL 04/2

The structture and behavior of barotropically unstable and stable wave disturbances in the vicinity of a zonally varying easterly jet are studied numerically with a linearized barotropic vorticity equation on a beta-plane. The easterly jet is approximated by a Bickley jet with a slow zonal variation. The numerical results are also compared with a simple mechanistic analytical model using the local phase speed and growth rate concepts. The results are grossly similar in several respects to that expected from the parallel flow theory of barotropic instability, however, the resultant structure of the waves causes a spatial growth rate greater than predicted by the local growth rates computed with a parallel flow model. In the stable region, the structure leads to strong dynamic damping. When a uniform advective velocity is added to a variable mean flow, the differences between the behavior of the computed waves and that implied by the parallel flow theory are somewhat reduced. The waves remove kinetic energy from the mean flow and most of this energy is removed on the downwind side of the jet. The computed structure and behavior of the waves have a number of features that resemble those observed in the vicinity of the upper troposphere easterly jet during the summer monsoon. GRA

N78-16554# Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla.
SURFACE WIND MAPS FOR THE WESTERN INDIAN OCEAN FROM AUGUST 1975 TO OCTOBER 1976
Jose-Fernandez Partagas and Walter Duing Oct. 1977 88 p refs
(Contract N00014-75-C-0173)
(AD-A047305) Avail: NTIS HC A05/MF A01 CSCL 04/2

The interaction between ocean and atmosphere is particularly pronounced in the Arabian Sea and along its boundaries. The low-level atmospheric jet over East Africa and the Somali Current with its adjacent upwelling areas are prime examples of coupled air-sea phenomena. The large signals and the annual periodicity of these processes make them particularly attractive to the geophysical researchers, especially to oceanographers and meteorologists. As part of studying the influence of atmospheric motions on oceanic motions in the western Indian Ocean, maps describing the surface wind field for that area have been prepared at the University of Miami for a period of fourteen and a half months (mid-August 1975 to October 1976). The surface wind description given by these maps is more suitable for concurrent oceanographic studies than monthly mean winds obtained from climatological atlases: year-to-year variations and high horizontal resolution, which are averaged out in the atlas information, are retained on our maps. GRA

N78-16555# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
'PASS' 500 MB RAWINSONDE DATA. VOLUME 2: 18 NOVEMBER - 7 DECEMBER 1974
Edward M. D'Arcy Jun. 1977 349 p
(AD-A047001; ECOM-DR-77-4-Vol-2) Avail: NTIS HC A15/MF A01 CSCL 04/2

This volume is a continuation of volume I and contains data for 18 November through 7 December 1974. Author (GRA)

N78-16556# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
'PASS' 500 MB RAWINSONDE DATA, VOLUME 1 Data Report, Nov. - Dec. 1974
Edward M. D'Arcy Jun. 1977 349 p
(AD-A046979; ECOM-DR-77-4-Vol-1) Avail: NTIS MF A01 CSCL 04/2

This report contains the rawinsonde data to 500 mb that was taken during the 'PASS' experiment of November-December 1974. Ten-point-per-minute angular data are presented with mandatory and significant level data and time-pressure data. Author (GRA)

N78-16557# Oak Ridge National Lab., Tenn. Environmental Sciences Div.
RAINFALL SIMULATION FOR ENVIRONMENTAL APPLICATION

D. S. Shriner Aug. 1977 17 p refs
(Contract W-7405-eng-26)
(ORNL-5151; Publ-1067) Avail: NTIS HC A02/MF A01

Rain simulation systems have been designed for field and greenhouse studies which have the capability of reproducing the physical and chemical characteristics of natural rainfall. The systems permit the simulation of variations in rainfall and droplet size similar to that of natural precipitation. The systems are completely automatic and programmable, allowing unattended operation for periods of up to one week, and have been used to expose not only vegetation but also soils and engineering materials, making them versatile tools for studies involving simulated precipitation. ERA

N78-16558# California Univ., Davis. Dept. of Land, Air and Water Resources.
ANALYSIS OF THREE-DOPPLER RADAR DATA Final Report, 1 Mar. 1976 - 30 Jun. 1977
Kit K. Wagner Jun. 1977 7 p
(Grant NOAA-04-6-022-44023)
(PB-273158/6; NOAA-77091212) Avail: NTIS HC A02/MF A01 CSCL 04B

Computational algorithms were tested for the solution of linear algebraic equation sets in severe storm data evaluations. Assistance was given in coding a computer program to compute kinematic properties of storm motion. Refinements were introduced which determine mean storm motion. The output of that program is used by an analysis routine. This routine determined three-dimensional parcel trajectories from sequential time series of three-Doppler radar analysis of wind motion. GRA

N78-16559# Washington Univ., Seattle. Cloud Physics Group.
TRACER AND DIFFUSION AND CLOUD MICROPHYSICAL STUDIES IN THE AMERICAN RIVER BASIN Final Report, Oct. 1976 - Nov. 1977
Arthur L. Rangno, Peter V. Hobbs, and Lawrence F. Radke Aug. 1977 255 p
(Contract DI-6-07-DR-20140)
(PB-272426/8; FR-1) Avail: NTIS HC A12/MF A01 CSCL 04B

An airborne field study was conducted over the American River Basin of the Sierra Nevadas for the purpose of: (1) determining the transport and diffusion of materials released from the ground and the air during various types of storm situations; (2) comparing the observed plumes with those predicted by stratified tank model simulations; (3) obtaining cloud microphysical measurements; (4) obtaining airborne precipitation particle measurements in support of an auxiliary study comparing radar reflectivities and precipitation rates on the ground; and (5) searching for extraneous ice nucleus sources which could affect the Basin. GRA

N78-16560# Bureau of Reclamation, Denver, Colo. Div. of Atmospheric Water Resources Management.
PROJECT SKYWATER. A PROGRAM OF RESEARCH IN PRECIPITATION MANAGEMENT, VOLUME 1 Final Environmental Statement.
1977 378 p 3 Vol.
(PB-273294/9; INT-FES-77-39-Vol-1) Avail: NTIS HC A17/MF A01 CSCL 04B

The purpose, scope and environmental impacts of Project Skywater, the Bureau of Reclamation's research program in cloud seeding for enhanced precipitation, are presented in the format of a final programmatic environmental statement. Two numerical ratings were given for each potential impact, one applicable to the research program and the other applicable if the technology being developed by Project Skywater is applied in a long-term, continuous and widespread mode. The environmental effects of the research program generally were described as in significant, if detectable. Research to date indicated effects of widespread application of the technology under development would be significant over agricultural lands and generally insignificant in mountainous regions. GRA

N78-16561# Bureau of Reclamation, Denver, Colo. Div. of Atmospheric Water Resources Management.
PRECIPITATION MANAGEMENT. VOLUME 2: APPENDICES A - J Final Environmental Statement
1977 207 p refs 3 Vol.
(PB-273295/6; INT-FES-77-39-Vol-2) Avail: NTIS HC A10/MF A01 CSCL 04B

The hydrologic cycle condensation and precipitation in the atmosphere is discussed in detail. Seeding agents currently in use were listed with an emphasis on silver iodide. Selected ecological aspects of the High Plains region were studied, and description of the agricultural, economic, and social factors were also included. B.B.

N78-16562# Bureau of Reclamation, Denver, Colo. Div. of Atmospheric Water Resources.
PROJECT SKYWATER. A PROGRAM OF RESEARCH IN PRECIPITATION MANAGEMENT. VOLUME 3: APPENDIX K Final Environmental Statement
1977 257 p 3 Vol.
(PB-273296/4; INT-FES-77-39-Vol-3) Avail: NTIS HC A12/MF A01 CSCL 04B

Copies of letters sent to agencies, organizations, and individuals requesting review of and comment on the Draft Environmental Statement were appended. A news release on the availability of the statement and notice of public hearings was included, as well an index of agency, organization and individual comments. A copy of a letter to organizations concerned with possible historical, architectural, archeological or cultural impacts from the Skywater program was examined along with transcripts of public hearings. B.B.

N78-16563# National Weather Service, Salt Lake City, Utah. Western Region.
STATISTICAL GUIDANCE ON THE PREDICTION OF EASTERN NORTH PACIFIC TROPICAL CYCLONE MOTION, PART 2
Preston W. Leftwich and Charles J. Neumann Aug. 1977 24 p refs
(PB-273155/2; NOAA-TM-NWS-WR-125-Pt-2; NOAA-77091208) Avail: NTIS HC A02/MF A01 CSCL 04B

The system is one of three components of a statistical prediction package developed to provide objective guidance for the forecasting of tropical cyclone motion over the eastern North Pacific Ocean. The forecasts are statistical combinations of forecasts made by a simulated analog model and forecasts made by predictors derived from synoptic data. GRA

N78-16564# National Oceanic and Atmospheric Administration, Rockville, Md. Federal Coordinator for Marine Environmental Prediction.
FEDERAL PLAN FOR MARINE ENVIRONMENTAL PREDICTION, FISCAL YEAR 1977
Ralph E. Meguire, Jr., ed. May 1977 53 p
(PB-273151/1; NOAA-77091301; NOAA-S/T-77-2609) Avail: NTIS HC A04/MF A01 CSCL 04B

This Federal Plan summarizes the Marine Environmental Prediction (MAREP) Program for the basic and specialized MAREP services. The basic MAREP Service provides for the acquisition, communication, and processing of data and dissemination of oceanic information including collection, transmission, and analysis of data and issuance of advisories, warnings, and forecasts. Specialized MAREP services draw upon the data output of the basic service. They provide support for maritime commerce, water quality assessment, living and nonliving marine resource programs, and national security. GRA

N78-16565# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
MARINE STRATOCUMULUS CONVECTION
Wayne H. Schubert, Joseph S. Wakefield, Ellen J. Steiner, and Stephen K. Cox Jul. 1977 146 p refs
(Grant NSF ATM-76-09370)
(PB-272955/6; AS-Paper-273) Avail: NTIS HC A07/MF A01 CSCL 04B

Large areas of persistent low level marine stratocumulus clouds occur primarily over the cool eastern oceans in the strong subsidence to the east of the subtropical oceanic high pressure cells. The climatology of these areas is reviewed, after which the authors present a coupled convective-radiative boundary layer

model of such stratocumulus convection. Approximate analytic solutions are given. The design of an observational program to more completely test the theory is briefly discussed. GRA

N78-16566# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
CASE STUDY OF CONVECTION LINES DURING GATE M.S. Thesis
R. N. Mower, A. K. Betts, and S. K. Cox Jun. 1977 105 p refs Sponsored in part by NOAA
(Grant NSF OCD-74-21678)
(PB-272943/2; AS-Paper-271; ISSN-0067-0340) Avail: NTIS HC A06/MF A01 CSCL 04B

The dynamics and thermodynamics of two lines of active convection located within the GATE B-scale ship array are described. Compositing data from 5 aircraft indicates a region of strong convergence near the surface ahead of the lines (approximately 0.001/s) with a somewhat weaker divergence to the rear associated with a region of downdraft air. The lines appear to be similar to tropical squall-lines with block inflow to the south and block outflow to the north. GRA

N78-16567# National Weather Service, Redding, Calif.
STUDY OF A HEAVY PRECIPITATION OCCURRENCE IN REDDING, CALIFORNIA
Christopher E. Fontana Jun. 1977 24 p refs
(PB-273914/2; NOAA-TM-NWS-WR-123; NOAA-77071809) Avail: NTIS HC A02/MF A01 CSCL 04B

The synoptic pattern preceding and during the thunderstorms is presented. The precipitation pattern is discussed, using the radar displays from the WSR-57 radars at Medford, Oregon and Sacramento, California. GRA

N78-16568# National Climatic Center, Asheville, N. C.
METEOROLOGY DATA REPORT: HIGH ALTITUDE METEOROLOGICAL DATA, VOLUME 13, NUMBER 3
1977 740 p
(PB-273608/0; NOAA-77092128) Avail: NTIS HC A09/MF A01 CSCL 04B

Wind and temperature measurements from all available meteorological sounding rocket firings are presented, along with computed values for pressure, density, and speed of sound. Local radiosonde observations, and current month means and standard deviations are also presented. Author

N78-16569# National Weather Service, Salt Lake City, Utah. Western Region.
TROPICAL CYCLONE KATHLEEN
James R. Fors Feb. 1977 40 p refs
(PB-273676/7; NOAA-TM-NWS-WR-114; NOAA-77092209; WR-114) Avail: NTIS HC A03/MF A01 CSCL 04B

Tropical Cyclone Kathleen moved through the Western United States on September 10-12, 1976. The objective precipitation guidance was of limited help in forecasting heavy rain situations. The limited fine mesh model forecasts were somewhat better in overall quantitative precipitation forecast guidance. Kathleen maintained her intensity unusually far north. Her rapid speed of movement; above normal sea surface temperatures; advection of warm, moist air from the Gulf of California, and nonelliptic upper tropospheric flow are suggested as possible mechanisms in maintaining her intensity. GRA

N78-16570# National Weather Service, Salt Lake City, Utah.
OPERATIONAL FORECASTING USING AUTOMATED GUIDANCE
Leonard W. Snellman Feb. 1977 28 p refs
(PB-273663/5; NOAA-TM-NWS-WR-111; NOAA-77092207) Avail: NTIS HC A03/MF A01 CSCL 04B

The subject of automation in operational meteorology was addressed. It was suggested that persons involved in operational meteorology should strongly promote the development and use of objective guidance. Management decisions now being formulated on operational practices and the effect of these decisions on meteorological education may determine whether operational forecasting lives or dies as a satisfying career in the future. There exists tremendous potential for improvement of forecasting in the coming years and much improvement can be expected to come from advances in data collection, modelling, and statistical output. GRA

N78-16571# National Weather Service, Bakersfield, Calif. Weather Service Office.
A WINTER SEASON MINIMUM TEMPERATURE FORMULA FOR BAKERSFIELD, CALIFORNIA, USING MULTIPLE REGRESSION
Michael J. Oard Feb. 1977 19 p refs
(PB-273694/0; NOAA-TM-NWS-WR-113; NOAA-77092208) Avail: NTIS HC A02/MF A01 CSCL 04B

The results of using stepwise multiple regression to form a short-term minimum temperature prediction equation for the winter fruit-frost program at Bakersfield, California is described. Local data available the evening before were used. It was assumed that use of local data and a short time period in a stepwise regression program would provide better minimum temperature guidance. The results show that the temperature forecast aid developed was better than MOS and the two older aids. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N78-16572 Oregon State Univ., Corvallis.
SMALL SCALE TEMPERATURE STRUCTURE OF THE UPPER OCEAN Ph.D. Thesis
James Joseph Simpson 1977 159 p
Avail: Univ. Microfilms Order No. 77-23412

Small scale temperature structure of the upper ocean was examined in terms of measurement and analysis of the heat balance at the sea surface, the distribution of downward irradiance with depth, the radiometrically determined sea surface temperature, and the temperature and salinity of the upper 300 meters. Profiles of salinity and temperature indicate that there was usually a well mixed layer near the surface, although during light winds, a diurnal thermocline was evident. The structure below the thermocline was often complex with temperature inversions as large as 0.5 C. These inversions were compensated by salinity so that the density profile was stable. The depth of the well mixed layer was correlated with mechanical energy input by the wind but was also influenced by horizontal advection of water having differing characteristics. Dissert. Abstr.

N78-16573 Florida Univ., Gainesville.
HYDRODYNAMIC INSTABILITY IN THE SURF ZONE AND THE FORMATION OF RIP CURRENT GYRES Ph.D. Thesis
Christopher David Miller 1977 244 p
Avail: Univ. Microfilms Order No. 77-24781

An analytical approach was adopted to the modelling of the wave-induced horizontal circulation on a mildly sloping beach. The cellular flow that was favored when the waves come in normal to the bottom contours is of special interest. The determination of the longshore dimension of the cells as a function of the physical parameters of the problem and to reproduce the broad outlines of the circulation was of special interest. Two distinct dynamic regions were considered: the zones seaward and shoreward of the breaker line. The system was very responsive to the mean sea surface slope and its shore-normal derivative across the breaker line. A supporting heuristic model was used to clarify and corroborate some aspects of the main model. Dissert. Abstr.

N78-16574 Rhode Island Univ., Kingston.
REMOTE DETERMINATION OF SEDIMENT PARAMETERS IN A MULTI-LAYERED SEA BOTTOM Ph.D. Thesis
John Irving Salisbury 1977 133 p
Avail: Univ. Microfilms Order No. 77-24061

Two seismic processing techniques were developed to determine the average layer velocity, layer depth, and the reflection coefficients of the boundaries of a multi-layered ocean floor. The processors operate on the seismic data recorded by an array of hydrophones located on the ocean surface. The processor for determining the boundary reflection coefficient for normal incidence is referred to as the Reflection Coefficient

Processor. A parameterized seismic model is used to predict the impulse response of a multilayered ocean floor. The parameters in the model are the reflection coefficients of the layer boundaries. The estimated seismic signal from the model is compared with actual recorded data. The parameters in the model are adjusted until convergence is obtained. The model parameters at this point are the desired layer reflection coefficients.
Dissert. Abstr.

N78-16575 Rutgers - The State Univ., New Brunswick, N. J.
A NUMERICAL HYDRODYNAMIC ASSESSMENT OF A STABILIZATION STRATEGY FOR AN ATLANTIC COASTAL INLET Ph.D. Thesis
Thomas Joseph Harlukowicz 1977 420 p
Avail: Univ. Microfilms Order No. 77-24084

The impact that a proposed stabilization plan will have on the tidal regimen of an Atlantic Coast inlet is predicted. Numerical modeling techniques were applied in the form of a mathematical model. An explicit finite difference algorithm integrated the basic tidal hydrodynamic equations while density gradients were assumed negligible. Numerical properties of the linear wave equation were derived. Stability and numerical velocity errors were focused on and the von Neuman approach was employed for evaluating stability properties of simple two dimensional wave propagation in an inertial and non inertial reference system. Channel depth distortion increase the error in wave component speeds, but only slightly. In all cases the numerical waves lag behind the true propagating speed of the wave. Dissert. Abstr.

N78-16576 Washington Univ., St. Louis, Mo.
CORRELATION OF CENOZOIC DEEP SEA SEDIMENTS OF THE EQUATORIAL PACIFIC OCEAN: AN EXAMPLE OF A NEW CHRONOSTRATIGRAPHIC SYSTEM OF MEASUREMENT Ph.D. Thesis
Richard Gerald Blank 1977 150 p
Avail: Univ. Microfilms Order No. 77-26800

Relative age measurement was developed by a new approach. This approach quantifies a data set and statistically maximizes the probability that a fossil occurrence belongs in a particular position in a sequence of highest and lowest occurrences of fossils, and becomes the best representation of the known stratigraphic sequences for a data set. The approach is documented by using a paleontologic data set collected by the Deep Sea Drilling Project in the equatorial Pacific Ocean. The relative age standard has been calibrated to absolute age. It has effectively normalized foraminiferal, radiolarian, and calcareous nanofossil standards of the data set. The age relationships of the geologic sections containing any combination of fossil occurrence from these fossil groups can be objectively compared. Dissert. Abstr.

N78-16577 Miami Univ., Coral Gables, Fla.
WIND-FORCED EQUATORIAL WAVES IN THE ATLANTIC OCEAN Ph.D. Thesis
Zachariah R. Hallock 1977 163 p
Avail: Univ. Microfilms Order No. 77-28935

During the GARP Atlantic Tropical Experiment north-south fluctuations in the equatorial current system were observed. Observations of current profiles during Phase 2 suggest that the fluctuations had a period of about 16 days and were propagating westward with a phase speed of 130 to 190 cm/sec. Evidence of fluctuations in the tradewinds at similar frequencies was also found. Analysis of profiling current meter data reveals that latitudinal shear in the zonal equatorial currents is important, and that meridional and vertical motions are highly time-dependent and have small means. Theoretical analysis of a linear, two-layer system shows that the characteristics of the observed fluctuations are consistent with the theory of linear, equatorially trapped waves, particularly the Yanai wave. Dissert. Abstr.

N78-16578 Yale Univ., New Haven, Conn.
A LABORATORY STUDY OF THE BAROMETRIC RESPONSE PROBLEM Ph.D. Thesis
Kenneth Harold Brink 1977 177 p
Avail: Univ. Microfilms Order No. 77-27806

The physical mechanism for the MODE observations by means of a joint laboratory and theoretical study is explained. The first part of the work is devoted to the consideration of possibly relevant effects in an f-plane ocean model. The effects of stratification and inertia-gravity wave transient motions are found to be small. The mechanism of atmospheric pressure change is shown to be important. If pressure change is local, sea surface response increases with increasing frequency at sub-inertial frequencies. If pressure changes are advective, sea surface response decreases with increasing speed. Over-reaction of the free surface to forcing, can occur when the free inertia-gravity modes of the basin are excited. Laboratory experiments which agree with the theory for the local pressure change mechanism to within assigned experimental error when corrections for effects peculiar to the laboratory model are included. Dissert. Abstr.

N78-16579 Oregon State Univ., Corvallis.
OBSERVATIONS OF VELOCITY AND TEMPERATURE AND ESTIMATES OF MOMENTUM AND HEAT FLUXES IN THE INTERNAL BOUNDARY LAYER OVER ARCTIC LEADS Ph.D. Thesis
Edgar L. Andreas 1977 275 p
Avail: Univ. Microfilms Order No. 77-29404

The primary purpose of the AIDJEX Lead Experiment of early 1974 was to measure the turbulent component of the heat flux from Arctic leads in winter. The experiment was summarized, the data taken on the downwind side of the leads was described, and the determination of the sensible and latent heat and momentum fluxes over Arctic leads was discussed. Methods used to evaluate the sensible heat flux included an energy conservation approach, empirically-determined flux-gradient relationships, and measurements of the correlation between vertical velocity and temperature fluctuations.
Dissert. Abstr.

N78-16580*# Oregon State Univ., Corvallis. School of Oceanography.
PARTICLE SIZE DISTRIBUTIONS AND THE VERTICAL DISTRIBUTION OF SUSPENDED MATTER IN THE UPWELLING REGION OFF OREGON Final Report
James C. Kitchen Aug. 1977 130 p refs
(Contract NAS5-22319)
(NASA-CR-156668; Ref-77-10) Avail: NTIS HC A07/MF A01 CSCL 08J

Various methods of presenting and mathematically describing particle size distribution are explained and evaluated. The hyperbolic distribution is found to be the most practical but the more complex characteristic vector analysis is the most sensitive to changes in the shape of the particle size distributions. A method for determining onshore-offshore flow patterns from the distribution of particulates was presented. A numerical model of the vertical structure of two size classes of particles was developed. The results show a close similarity to the observed distributions but overestimate the particle concentration by forty percent. This was attributed to ignoring grazing by zooplankton. Sensivity analyses showed the size preference was most responsive to the maximum specific growth rates and nutrient half saturation constants. The verical structure was highly dependent on the eddy diffusivity followed closely by the growth terms.
Author

N78-16581# Naval Postgraduate School, Monterey, Calif.
WAVE SET UP AND SET DOWN DUE TO A NARROW FREQUENCY WAVE SPECTRUM M.S. Thesis
Darwin James McReynolds Mar. 1977 43 p refs
(AD-A047121) Avail: NTIS HC A03/MF A01 CSCL 08/3

A narrow band wave spectrum was applied to theoretical relationships previously developed for set down and set up in an attempt to find second order non-steady solutions for these concepts. The initial effort was to apply this spectrum to the radiation stress tensor using linear wave theory. Another development was attempted by incorporating the spectrum and the solution of the long wave equation into the Bernoulli and vertical momentum equations. Results obtained indicate that the solution for mean water level outside the surf zone is composed of a steady component and a periodic unsteady component; the periodic component being of the form of a long wave with a frequency lower than the components of the wave spectrum. The solution for set up is then composed of the same type components. The exact relationships depend on the patching process that is made for the solutions through the breaker line.
Author (GRA)

N78-16582# Geological Survey, Reston, Va. Water Resources Div.

COMPUTER SIMULATION OF TWO-DIMENSIONAL UNSTEADY FLOWS IN ESTUARIES AND EMBAYMENTS BY THE METHOD OF CHARACTERISTICS: BASIC THEORY AND THE FORMULATION OF THE NUMERICAL METHOD Final Report

Chintu Lai Aug. 1977 84 p refs
(PB-273162/8; USGS-WRD-WRI-77/067; USGS-WRI-77-85) Avail: NTIS HC A05/MF A01 CSCL 08H

Two Dimensional unsteady flows of homogeneous density in estuaries and embayments were described by hyperbolic, quasi-linear partial differential equations involving three dependent and three independent variables. For the numerical solution, the specified time interval scheme was used. The computation was carried to the second order accuracy by using trapezoidal rule of integration. Means to handle complex boundary conditions were developed for practical application. Computer programs were written and a mathematical model was constructed for flow simulation. GRA

N78-16583# Oregon State Univ., Corvallis.

RESULTS OF AN INTERCALIBRATION AT SEA OF HYDROGRAPHIC AND CHEMICAL OBSERVATIONS AND STANDARDS ABOARD THE USSR SHIP PROFESSOR VIESE AND THE US RESEARCH VESSEL THOMAS G. THOMPSON DURING FDRAKE 76

Louis I. Gordon, George C. Anderson (Scripps Inst. of Oceanog., La Jolla, Calif.), and Worth D. Nowlin (Texas A and M Univ., College Station) Aug. 1977 28 p refs Sponsored by NSF (PB-273419/2; OSU-Ref-77-7; NSF/IDOE-77-145) Avail: NTIS HC A03/MF A01 CSCL 08J

Calibration standards for salinity, dissolved oxygen, and dissolved reactive phosphate and silicate were exchanged. The calibration standards were in very good agreement, the differences being insignificant with respect to measurement precision. The results showed average differences with regard to sign between the two ships' results for temperature, salinity, dissolved oxygen, reactive phosphate, and reactive silicate to be relatively small but the root-mean-square differences to be quite large. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N78-16584 Colorado State Univ., Fort Collins.

EFFECTS OF MATURATION AND HYPOXIA ON SKELETAL MUSCLE Ph.D. Thesis

Alberto Hugo Sillau-Gilone 1977 110 p
Avail: Univ. Microfilms Order No. 77-28328

Skeletal muscle capillarity, fiber composition and fiber geometry were studied using histochemical techniques, in normoxic and hypoxic rats and guinea pigs of different body weights. It was demonstrated that capillary density in the muscles of rats and guinea pigs is not affected by moderately severe hypoxia and that the number of capillaries around muscle fibers depends on their cross sectional area and on their oxidative activity. Dissert. Abstr.

N78-16585*# National Aeronautics and Space Administration, Washington, D. C.

STUDY OF THE BIOLOGICAL EFFECTS OF LONG-TERM WEIGHTLESSNESS IN LABORATORY MODEL EXPERIMENTS ON MAMMALS

Dec. 1977 35 p refs Transl. into ENGLISH from 'Izucheniye Biologicheskikh Effektov Dlitelnoy Nevesomosti v Laboratornykh Model nykh Eksperimentakh na Mlekopitayushchikh Zhivotnykh', Rept. 10/77-1 Interkosmos Council, Moscow, 1977 p 1-40 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original Doc. Prep. by Interkosmos Council, Acad. of Sciences USSR and Directorate of Space Biol. and Med., Min. of Health USSR
(Contract NASw-2790)
(NASA-TM-75076) HC A03/MF A01 CSCL 06S

Experimental ground and space flight hypokinesia and hypodynamia of monkeys, dogs and rats, as models for the effects of weightlessness in manned space flight were studied. Effects on nonspecific adaptation, the cardiovascular system, water and electrolyte metabolism and on skeletal muscles and bones of the limbs were of major interest. It is concluded that rodents are not suitable models for cardiovascular activity while dogs and monkeys are, and that all are suitable for the remaining types of studies. Hypodynamia is preferred over hypokinesia. Experiments with rats and dogs, for all functions studied, should provide body inclination to increase the central volume of blood. Author

N78-16586*# National Aeronautics and Space Administration, Washington, D. C.

FORMATION OF ECTOPIC OSTEOGENESIS IN WEIGHTLESSNESS

Dec. 1977 8 p Transl. into ENGLISH from "Formirovaniye Ektopicheskogo Osteogeneza v Nevesomosti", Rept. (Moscow), 1977 p 1-6 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original Doc. Prep. by Acad. of Sciences USSR
(Contract NASw-2790)
(NASA-TM-75079) Avail: NTIS HC A02/MF A01 CSCL 06S

An ectopic osteogenesis experiment aboard the Cosmos-936 biosatellite is described. Decalcified, lyophilized femur and tibia were implanted under the fascia or in the anterior wall of the abdomen in rats. Bone formation before and after the tests is described and illustrated. The extent of formation of ectopic bone in weightlessness did not differ significantly from that in the ground controls, but the bone marrow of the ectopic bone of the flight rats consisted exclusively of fat cells. The deficit of support-muscle loading was considered to cause the disturbance in skeletal bone tissue development. Author

N78-16587*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va. Technology Utilization.

ADVANCES IN STERILIZATION AND DECONTAMINATION: A SURVEY

1978 190 p refs Prepared in cooperation with Bionetics Corp., Hampton, Va.
(Contract NAS1-14209)
(NASA-SP-5105) Avail: NTIS HC A09/MF A01 CSCL 06M

Recent technical advances made in the field of sterilization and decontamination and their applicability to private and commercial interests are discussed. Government-sponsored programs by NASA produced the bulk of material presented in this survey. The summary of past and current research discussed is detailed to enhance an effective transfer of technology from NASA to potential users. Author

N78-16588# Los Alamos Scientific Lab., N. Mex.

LASER BACKSCATTERING MEASUREMENTS ON BIOLOGICAL CELLS: PRELIMINARY RESULTS

G. C. Salzman, B. J. Price, R. D. Hiebert, P. F. Mullaney, and J. W. M. Visser 1976 26 p refs Repr. from Proc. of the Workshop on separation of normal and Neoplastic Cells (Amsterdam), 1976 26 p Presented at the Workshop on Separation of Normal and Neoplastic Cells, Amsterdam, 9-11 Nov. 1976; sponsored by The Netherlands Soc. Against Cancer
(Contract W-7405-eng-36)
(LA-UR-76-2462; Conf-761132-1) Avail: NTIS HC A03/MF A01

A cell flow-system instrument is described in which the light scattered by a cell as it passes through a focused helium-neon laser beam is detected simultaneously at 26 angles between 0 deg and 4.4 deg and at 176 deg with respect to the laser beam axis. The usefulness of backscatter in distinguishing among variously sized plastic microspheres is demonstrated. Preliminary results with mouse bone marrow cells are also discussed. ERA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N78-16589 Rutgers - The State Univ., New Brunswick, N. J.

THE EFFECT OF ACUTE ARTERIAL HYPOXIA ON THE PARAMETERS OF O2 SUPPLY AND DEMAND IN THE

RESTING GRACILIS MUSCLE OF THE ANESTHETIZED DOG Ph.D. Thesis
George Jeffrey Crystal 1977 177 p
Avail: Univ. Microfilms Order No. 77-24965

Particular attention was given to the relative roles of local and remote vascular control mechanisms. Animals respired room air or various low O2 gas mixtures. Steady state responses to hypoxia were obtained in intact (innervated) muscles and after (1) local denervation, (2) systemic alpha blockade with phenoxybenzamine, or (3) arterial baro- and chemoresceptor denervation. Results indicated that O2 supply/demand balance in resting skeletal muscle during arterial bypoxia was not influenced by direct chemoreceptor-mediated vasoconstrictor nerve activity, reflex vasoconstrictor support, or the background level of sympathetic adrenergic vasoconstrictor nerve tone.Dissert. Abstr.

N78-16590 Bowling Green State Univ., Ohio.
THE RELATIONSHIP BETWEEN THE ACOUSTIC REFLEX AND LOUDNESS DISCOMFORT IN NORMAL AND SENSORINEURAL EARS Ph.D. Thesis
Harry Lee McLeod 1977 71 p
Avail: Univ. Microfilms Order No. 77-23190

The relationship between loudness discomfort level (LDL) and the acoustic reflex threshold (ART) was investigated. Pre-recorded, randomly presented stimuli of 1000 Hz, 2000 Hz, and a multi-talker speech noise were presented to 15 normal and 15 sensorineural hearing-impaired listeners. The psychophysical method of constant stimuli was employed to determine the LDL. An analysis of variance was performed to determine if significant differences existed between LDL-ART measures for normal and hearing-impaired groups. A multiple regression analysis was used to determine the usefulness of ART measures in predicting LDL. Both LDL and ART were found to be significantly high for the hearing-impaired group. Ranges of prediction error were selected to investigate the ability of ART to predict LDL.
Dissert. Abstr.

N78-16591 Texas Univ., Austin.
SLEEP STAGE CLASSIFICATION USING BEAT-BY-BEAT HEART RATE DATA Ph.D. Thesis
Terry Paul Daubek 1977 108 p
Avail: Univ. Microfilms Order No. 77-22936

Research to determine if computer analysis of heat rate data can be used to detect sleep stages in human beings is presented. Sleep staging has traditionally been detected and measured by examination of the electroencephalogram and the electro-oculogram. It is the goal of this research to develop a technique that will detect sleep stages using only measures extracted from heart rate data. The method used in this research involved the use of one night of data per subject which had been categorized using standard EEG examination. These data were used as training data for a cluster generation-template matching algorithm which in turn was used to categorize other nights of data from the same subject. The results of this research are based upon sixteen nights of data from three subjects. Each night of data was transformed using a Fourier analysis algorithm.
Dissert. Abstr.

N78-16592 Syracuse Univ., N. Y.
PARTICLE DEPOSITION IN BENDS AND REPEATEDLY BIFURCATING TUBES Ph.D. Thesis
Yung-Sung Cheng 1976 147 p
Avail: Univ. Microfilms Order No. 77-24361

Two specific problems related to the local deposition of inhaled particles in the respiratory tract were studied: (1) inertial impaction in 90 deg bends, and (2) particle deposition in a tracheobronchial tree model. The equations of particle motion were solved analytically for an idealized airflow profile and numerically for a more realistic flow pattern in curved tubes. Deposition velocities were measured along both inner and outer edges of the daughter tubes of the second bifurcations in a tracheobrochial tree model consisting of four successive generations of bifurcations.
Dissert. Abstr.

N78-16593 Michigan State Univ., East Lansing.
IMPLANTABLE ELECTROMAGNETIC FIELD PROBES IN FINITE BIOLOGICAL BODIES Ph.D. Thesis
Seyed Hossein Mousavinezhad 1977 181 p
Avail: Univ. Microfilms Order No. 77-25270

Theoretical and experimental results are presented on the study of a dielectrically coated, small spherical probe used to measure the induced EM fields in conducting biological bodies of finite extent. The receiving and radiating characteristics of the insulated probe were determined as functions of the electrical parameters and geometry of a spherical coducting body. A general theory for a wire probe in a volume conductor was presented and the relation between the output of the probe and the induced electric field in the body was derived. The expression for the input impedance was formulated based both on the matrix equation method and transmission line theory. Experimental results on the input impedance of insulated spherical probes and the measurements of the induced electric field inside conducting bodies are presented.
Dissert. Abstr.

N78-16594 Notre Dame Univ., Ind.
THE ACTIVATION OF HUMAN PLASMINOGEN BY UROKINASE Ph.D. Thesis
Bernard Norman Violand 1977 177 p
Avail: Univ. Microfilms Order No. 77-27108

Plasminogen is the inactive plasma precursor of the proteolytic enzyme plasmin. The major physiological function of plasmin appears to be lysis of the fibrin clot. The molecular events which occur during the conversion of human plasminogen to plasmin by the human kidney activator, urokinase are discussed. The initial step in plasmin formation is the urokinase-catalyzed cleavage of an internal arginyl-valyl bond in native plasminogen (plasminogen a) to yield the two chain plasmin a molecule. This plasmin a contains a heavy chain (H a) derived intact from the original amino terminus of plasminogen a and a light chain derived intact from the carboxyl terminus of plasminogen a. However, the final stable plasmin, plasmin b, which is obtained, contains a heavy chain, H b, which arises by plasminolysis of a small peptide from the amino terminus of H a. Alternatively, plasmin b can be formed in a separate series of reactions which initially involves plasminolysis of plasminogen a to yield plasminogen b.
Dissert. Abstr.

N78-16595 Iowa State Univ. of Science and Technology, Ames.
COMPREHENSIVE STUDY INTERRELATING CARDIAC FUNCTION AND FUNDAMENTAL MUSCLE MECHANICS Ph.D. Thesis
John Richard Buysman 1977 145 p
Avail: Univ. Microfilms Order No. 77-25973

Fundamental muscle mechanics and basic physical principles are described and combined into a comprehensive functional model of the left ventricle which describes the entire cardiac cycle. It demonstrates quantitatively how cardiac function results from simple interactions between the fundamental muscle components functioning in one dimension within the three-dimensional framework of the ventricle. A small digital computer program calculates and graphically presents information such as force, element lengths, velocities of shortening, pressure, and flow. Simulation of the model demonstrates complex internal and external relationships which cannot be measured directly. The interactions can be quantified, timed, and placed into appropriated perspective within the limits of the model. The model is used to study cardiac performance indices and define their limitations, interferences, and exceptions.
Dissert. Abstr.

N78-16596 Oklahoma Univ. Health Sciences Center, Norman.
AN ANALYSIS OF ELECTRODERMAL REFLEX ACTIVITY Ph.D. Thesis
Patricia Jean Bernthal 1977 117 p
Avail: Univ. Microfilms Order No. 77-26466

Some physiologic aspects of the electrodermal reflex were studied in cats in a quantitative fashion. The amplitude of the reflex over time declined to 50% of control in approximately 160 minutes. The reflex amplitude in intact anesthetized cats was significantly reduced, although not abolished, by spinal transection or midcollicular decerebration. Intravenous administration of epinephrine resulted in a dose-dependent inhibition of both the reflexly and peripherally evoked electrodermal responses. This inhibitory effects on the peripheral response was antagonized by the alpha-adrenergic blocker phentolamine, but not by the beta-adrenergic blocker propranolol. A vascular mode of inhibition

was eliminated by the lack of effect of angiotensin on the electrodermal responses. The presence of a peripheral inhibitory alpha-adrenergic receptor in the sudomotor system was postulated. Dissert. Abstr.

N78-16597 Rochester Univ., N. Y.
BONE CELL COLLAGENASE Ph.D. Thesis
J. Edward Puzas 1977 87 p
Avail: Univ. Microfilms Order No. 77-25581

The enzyme necessary to initiate degradation of the organic collagen phase of bone was found in the culture fluids of resorbing bone. It is a true collagenase which is substrate specific Ca(+)2 requiring, inhibited by serum factors and cleaves a tropocollagen molecule into characteristic macromolecular fragments. The enzyme was demonstrated in an extract of freshly isolated fetal bone cells. In addition the secretory mechanism that is present in vivo is also present in the isolated cell preparation. In order to demonstrate an effect of parathyroid hormone (PTH) and other bone metabolic modifiers on the synthesis and secretion of collagenase it was necessary to develop a culture-assay system. Dissert. Abstr.

N78-16598 Georgetown Univ., Washington, D.C.
THREE-DIMENSIONAL RECONSTRUCTION AND DISPLAY OF ANATOMICAL AND PATHOLOGICAL STRUCTURES FROM THEIR SERIAL SECTIONS Ph.D. Thesis
John Charles Mazziotta 1977 157 p
Avail: Univ. Microfilms Order No. 77-26394

A computer system known as THREAD has the capability of producing three-dimensional images of both microscopic and gross structures when the input to the system is in the form of two-dimensional serial sections. The serial input images can be in the form of 35 mm film negatives, obtained from serial electron or light micrographs, or in the form of digital magnetic tape on which are stored serial sets of cross-sectional computerized tomograms of live patients. The qualitative three-dimensional images can be either in the form of line-drawing contour-grams or in the form of shaded half-tone images. The quantitative results include sectional perimeters and areas as well as the total object volume. Quantitative results are obtained automatically and qualitative results require only minimal manual supervision for their production. Dissert. Abstr.

N78-16599 Texas Technological Univ., Lubbock.
A MATHEMATICAL ANALYSIS OF THE MUSCULO-SKELETAL SYSTEM OF THE HUMAN SHOULDER JOINT Ph.D. Thesis
Young-Pil Park 1977 191 p
Avail: Univ. Microfilms Order No. 77-25513

A mathematical model capable of predicting muscular tension characteristics for skeletal muscles in the human shoulder joint was developed. This was done by using the data that were collected through dissection of a cadaver and through physiological information about human skeletal muscles and anatomical characteristics of the human shoulder joint. General equations that can be applied to various individual persons who have different anthropometric dimensions were developed by using scale factors. Computer programs were developed to determine the muscular tension in muscles in the shoulder joint of various persons and to predict the linear coefficients between electromyographic electrical signal intensities and the muscular tensions of the skeletal muscles. Dissert. Abstr.

N78-16600 Cincinnati Univ., Ohio.
SOME LATENCY AND RELAXATION MEASURES OF THE ACOUSTIC REFLEX IN RESPONSE TO WHITE NOISE AND PURE TONES, IN SUBJECTS WITH NORMAL HEARING AND SUBJECTS WITH SENSORINEURAL HEARING LOSS Ph.D. Thesis
Zenobia Ratanshaw Bagli 1977 176 p
Avail: Univ. Microfilms Order No. 77-29702

Ten normal hearing subjects were matched in age and sex to ten subjects with mild to moderate sensorineural hearing loss. The reflex eliciting stimuli were comprised of pure tones (500 Hz, 1000 Hz, 2000 Hz) and white noise, with rise-decay times of 25 milliseconds and 50 milliseconds, signal duration of 500 milliseconds and an interstimulus interval of 3000 milliseconds. The results indicated that the time taken by the tympanic muscles in contracting and relaxing differs in normal ears and ears with sensorineural hearing impairment. Ears with sensorineural loss took longer to contract and relax than normal ears. These results were interpreted to be suggestive of some sort of neural delay either in encoding or in transmission, in the presence of sensorineural damage. Dissert. Abstr.

N78-16601 Virginia Univ., Charlottesville.
RETINAL ROD OUTER SEGMENT DISCS: A STUDY OF MEMBRANE STRUCTURE AND FUNCTION Ph.D. Thesis
Henry Gilbert Smith, Jr. 1977 138 p
Avail: Univ. Microfilms Order No. 77-28612

The photoactive discs of vertebrate photoreceptors, found within the retinal rod outer segments were studied. Osmotically intact discs were prepared from retinal rod outer segments by osmotic shock followed by flotation on 5% Ficoll. The lipid structure of discs was studied with the nonmembrane penetrating labeling reagent, trinitrobenzenesulfonate. It was concluded that the disc has a markedly asymmetric membrane with these lipids distributed preferentially in the outer surface. The possible function of the discs as light activated calcium stores was also studied and found to be important in visual excitation. Dissert. Abstr.

N78-16602 Oregon Univ., Eugene.
PHYSIOLOGICAL WORK CAPACITY AND EFFICIENCY OF ADULTS DURING SHORT DURATION HIGH INTENSITY WORK WHILE ENGAGED IN A SPECIFIC LOW CARBOHYDRATE, LOW CALORIE DIET Ph.D. Thesis
Peter Adrian Rich 1977 87 p
Avail: Univ. Microfilms Order No. 77-19353

The subjects, twenty-seven adult male ranging in age from 16 to 50 years, after random assignment to one of four experimental groups, underwent a testing period prior to embarking on the dietary regimen. The statistical analyses revealed no significant differences between any of the experimental groups on the variables that were studied. It was, therefore, concluded that the dietary regimen chosen for study did not place any limitation on the ability of the subjects engaged in this investigation, to perform short duration, high intensity work on the bicycle ergometer. These findings lead to the hypothesis that the experimental conditions had not sufficiently reduced body glycogen stores to a level that would have influenced work performance. It was further hypothesized that gluconeogenesis from proteins and fats in combination with the small amount of carbohydrate furnished by the diet was the mechanism by which the carbohydrate demands of the final work bout were met. Dissert. Abstr.

N78-16603 Pennsylvania Univ., Philadelphia.
PULMONARY ARTERIAL TREE: ARCHITECTURAL AND FUNCTIONAL DESIGN Ph.D. Thesis
Ramalingaier Gopalakrishnan 1977 209 p
Avail: Univ. Microfilms Order No. 77-19852

Histological studies were accomplished in the larger pulmonary arteries, fixed at different transmural loads, to examine their geometry, structure and their variation. Measurements of velocity profiles in the pulmonary trunk and main branches were also accomplished in anesthetized dogs. Model studies were designed to measure velocity profiles and dimensions in straight, elliptical vessels. To assess the importance of the observed geometric and structural features of the vessels in function, a nonlinear, distributed model was developed for a system incorporating the pulmonary trunk, main branches and lobar arteries. In conclusion, the observed geometry, structure and architecture appear essential for optimal function of the system. Thus alteration of any of these features may be expected to result in a deteriorated performance and pathological adaptation in the system. Dissert. Abstr.

N78-16604*# National Aeronautics and Space Administration, Washington, D. C.
CERTAIN ASPECTS OF THE VESTIBULAR PROBLEM IN SPACE MEDICINE
Dec. 1977 29 p refs Transl. into ENGLISH from Nektoryye Aspekty Vestibulyarnoy Problemy v Kosmicheskoy Meditsine (Moscow), Report, 1977 p 1-34 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original Doc. Prep. by Interkosmos Council, Academy of Sciences, USSR, Moscow

(Contract NASw-2791)
(NASA-TM-75067) Avail: NTIS HC A03/MF A01 CSCL 06P

Vestibulovegetative disorders on manned space flights are discussed. A study relating to the vestibular stimuli in respiration, diaphoresis cardiac rhythm and a broad complex of hemodynamic indices was conducted. Certain tests for astronaut candidates are discussed. Author

N78-16605*# National Aeronautics and Space Administration, Washington, D. C.

PROGNOSIS OF THE STATE OF HEALTH OF A PERSON UNDER SPACEFLIGHT CONDITIONS

Dec. 1977 27 p refs Transl. into ENGLISH from Prognozirovaniye Sostoyaniya Zdorovya Chelokova u v Usloviyakh Kosmicheskogo (Moscow), report, 1977 p 1-33 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Interkosmos Council, Academy of Sciences USSR, Moscow
(Contract NASw-2791)
(NASA-TM-75068) Avail: NTIS HC A03/MF A01 CSCL 06S

Methods of predicting the state of health and human efficiency during space flight are discussed. Diversity of reactions to the same conditions, development of extrapolation methods of prediction, and isolation of informative physiological indexes are among the factors considered. J.M.S.

N78-16606*# National Aeronautics and Space Administration, Washington, D. C.

MATHEMATICAL MODELLING OF A HUMAN EXTERNAL RESPIRATORY SYSTEM

Dec. 1977 21 p refs Transl. into ENGLISH from Matematicheskoye Modelirovaniye Sistemy Uneshnego Dykhaniya Cheloveka (Moscow), Report no. 10/77-1, 1977 p 1-15 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Interkosmos Council, Academy of Sciences USSR and Ministry of Health, Moscow
(Contract NASw-2790)
(NASA-TM-75069) Avail: NTIS HC A02/MF A01 CSCL 06P

A closed system of algebraic and common differential equations solved by computer is investigated. It includes equations which describe the activity pattern of the respiratory center, the phrenic nerve, the thrust produced by the diaphragm as a function of the lung volume and discharge frequency of the phrenic nerve, as well as certain relations of the lung stretch receptors and chemoreceptors on various lung and blood characteristics, equations for lung biomechanics, pulmonary blood flow, alveolar gas exchange and capillary blood composition equations to determine various air and blood flow and gas exchange parameters, and various gas mixing and arterial and venous blood composition equations, to determine other blood, air and gas mixing characteristics. Data are presented by means of graphs and tables, and some advantages of this model over others are demonstrated by test results. Author

N78-16607*# National Aeronautics and Space Administration, Washington, D. C.

BASIC RESULTS OF THE MEDICAL RESEARCH CONDUCTED DURING THE FLIGHT OF TWO CREWS ON THE SALYUT-5 ORBITAL STATION

Dec. 1977 62 p Transl. into ENGLISH from "Osnovnyye Rezultaty Meditsinskikh Issledovaniy Provedennykh pri Polete Dvukh Ekipazhey na Orbital noy Stantsii 'Salyut-5". Rept. Interkosmos Council (Moscow), 1977 p 1-67 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Interkosmos Council, Acad. of Sci. USSR and the Directorate of Space Biol. and Med., Min. of Health USSR
(Contract NASw-2790)
(NASA-TM-75070) Avail: NTIS HC A04/MF A01 CSCL 06S

The study of the effect of space factors, especially weightlessness, on man, taking into account prophylactic measures and devices to counteract that effect was part of the program for two flights on the Salyut 5 orbital station. Information from the equipment on board was transmitted telemetrically including: an electrocardiogram; a sphygmogram of carotid and femoral arteries; a kinetocardiogram; a tacho-oscillogram of the humeral artery, perimetric oscillations of the femur, venous pulse and pressure in the jugular veins, vital capacity of the lungs, respiration rate and lung ventilation. Stress factors, metabolism, biological and bacteriological and other tests were included. A comparison was made between these data and pre- and postflight test result. Author

N78-16608*# National Aeronautics and Space Administration, Washington, D. C.

DYNAMICS AND CERTAIN MECHANISMS IN THE CHANGES OF THE SKELETAL-MUSCULAR SYSTEM OF MAN UNDER BEDREST CONDITIONS

V. G. Oganov Dec. 1977 37 p refs Transl. into ENGLISH from "Dinameka i Nekotoryye Mekhanizmy Izmeneniy v Oporno-myshechnoy Sisteme Cheloveka v Usloviyakh Postelnogo Rezhima", Rept. Interkosmos Council (Moscow), 1977 p 1-40 Transl. by SCITRAN, Santa Barbara, Calif. Original doc. prep. by Interkosmos Council, Acad. of Sci. USSR and Directorate of Space Biol. and Med., Min. of Health, USSR
(Contract NASw-2791)
(NASA-TM-75073) Avail: NTIS HC A03/MF A01 CSCL 06S

Bed rest conditions evaluated varied in the longitudinal axis of the body, perpendicular to the vector gravitational forces, and the cranial portion of the body inclined from the horizontal. The duration of bed rest fluctuated in various experiments from 30 to 182 days. The state of muscle and neuromuscular system was judged on the basis of the recording of various functional indices, as well as by certain results of morphological and biochemical studies and data from the study of motor functions. Author

N78-16609*# National Aeronautics and Space Administration, Washington, D. C.

APPLICATION AND EFFECTIVENESS OF PROPHYLACTIC DEVICES IN MODEL EXPERIMENTS

L. I. Kakurin Dec. 1977 15 p refs Transl. into ENGLISH from 'Primeneniye i Effektivnost Profilakticheskikh Sredstv v Model Nykh Eksperimentakh', Rept. Interkosmos Council (Moscow), 1977 p 1-16 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Interkosmos Council, Acad. of Sci. USSR and Directorate of Space Biol. and Med., Min. of Health USSR
(Contract NASw-2790)
(NASA-TM-75074) Avail: NTIS HC A02/MF A01 CSCL 06D

Material is presented for evaluating the effectiveness of prophylactic devices intended for maintaining: a relatively high functional level of the cardiovascular system; the nerve and muscle apparatus; and the water and salt status. The effects of the following are analyzed: physical training, lower body negative pressure, regulation of water and salt consumption, pharmacological preparations, and a combination of these. The author points out the need for further research. Author

N78-16610*# National Aeronautics and Space Administration, Washington, D. C.

MATTERS OF SIMULATION OF THE SEMICIRCULAR CANAL SYSTEM

V. S. Gurfinkel and S. V. Petukhov Dec. 1977 27 p refs Transl. into ENGLISH from "Voprosy Modelirovaniya Sistemy Polukruzhnykh Kanalov", Leningrad, 1977 p 148-160 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-2790)
(NASA-TM-75230) Avail: NTIS HC A03/MF A01 CSCL 06P

A scale model of the human semicircular canal system was developed based on the theory of dynamic similitude. This enlarged model makes it convenient to conduct tests on the vestibular processes and dynamics in the semicircular canals. Tests revealed hydromechanical interaction between canals, with asymmetry of the conditions of movement of the endolymph in the canals in opposite directions. A type of vestibular reactions, occurring with angular oscillations of the head, was predicted and demonstrated using this model and human test subjects. Author

N78-16611# Joint Publications Research Service, Arlington, Va.

TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY BIOMEDICAL AND BEHAVIORAL SCIENCES, NO. 19

12 Jan. 1978 108 p Transl. into ENGLISH from Selected Foreign Periodicals (USSR)
(JPRS-70469) Avail: NTIS HC A06/MF A01

The physiological effects of vibration were investigated and

problems of protection from vibration were examined. Information concerning biochemistry, epidemiology, veterinary medicine, toxicology and other biomedical sciences is also presented.
B.L.P.

N78-16612# New York Univ., N. Y.
PHYSIOLOGICAL RESPONSES TO COLD Final Report, 1970 - 1976
Steven M. Horvath (Calif. Univ., Santa Barbara) Dec. 1976 27 p refs
(Grant PHS-1-R13-ES-01470-01)
(PB-273254/3; NIH/NIEHS-77/017) Avail: NTIS CSCL 06S

The successful response of man to a cold ambient environment, dependent upon behavioral and physiological mechanisms, was explored. It was found that behavioral factors involve a complex interplay utilizing other elements of the environment to protect against the impacting one. Physiological responses are also involved. The responses to cold environments are integrated within the thermoregulatory centers in the brain. Body size or obesity show no relation to shivering activity; relative humidity has no significant effect on heat loss. During conditions of exercise, however, total evaporative loss can be increased as a result of increased ventilation and the active secretion of sweat. GRA

N78-16613# New York Univ., N. Y. Task Force for Research Planning in Environmental Health Sciences.
FEMALES AND HOT ENVIRONMENTS Final Report, 1970 - 1976
Steven M. Horvath (Calif. Univ., Santa Barbara) Oct. 1976 17 p refs
(Grant PHS-1-R13-ES-01470-01)
(PB-273257/6; NIH/NIEHS-77/017) Avail: NTIS HC A02/MF A01 CSCL 06S

Those responses of the female that are a result of cultural experience were separated from those that have a basis in physiological fact. Different investigators have reported levels of sweating in females to be similar, less than, or equivalent to those observed in male subjects. Since young women were the subjects of most studies, the influence of age and altered endocrine balance was not determined. Other areas needing clarification include the relation of menstruation and the ability to perspire; the relation of salt and water balance to the response of humans to hyperthermia; and details of the complex circulatory adjustments of women exposed to heat. GRA

N78-16614# Battelle Pacific Northwest Labs., Richland, Wash.
EVALUATING THE EFFECTS OF LOW-LEVEL CHRONIC EXPOSURES
E. S. Gilbert Sep. 1976 18 p refs Presented at the 2nd ERDA Statist. Symp., Oak Ridge, Tenn., 25 Oct. 1976
(Contract E(45-1)-1830)
(BNWL-SA-5992; Conf-761023-4) Avail: NTIS HC A02/MF A01

Problems involved in assessing health effects of chronic low-level exposures to environmental contaminants are reviewed. This problem is illustrated by a study of health effects of occupational exposure to ionizing radiation at Hanford which was established in the 1940's as an installation for plutonium production. Over 33,000 workers have been employed there in jobs involving some exposure to radiation. Yearly records of this exposure were maintained for all such employees. The yearly exposures were measured in rems of ionizing radiation able to reach critical organs of the body. Even for those who routinely worked in radiation zones, yearly readings seldom exceeded one or two rems. Methods for assessing directly the health effects of continuing relatively small doses of radiation over a number of years are discussed that are applicable to evaluating exposures to other industrial and environmental contaminants. ERA

N78-16615# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: BIOMEDICAL AND BEHAVIORAL SCIENCES, NO. 18
29 Dec. 1977 64 p refs Transl. into ENGLISH from Russian articles
(JPRS-70395) Avail: NTIS HC A04/MF A01

An experienced pilot has developed his own image of fight, has worked out the skills to control the plane and read the instrument information only in the form inherent to him. He controls the plane with precise coordinated movements, spending a minimum of time in reading the information, and is thus less fatigued in flight. In order to keep the flight image vivid in his consciousness, the pilot must be trained constantly. If only one system of landing approach is used over a long duration, the special features of piloting according to a different system are erased from his memory. The flight image, the habits of working with cockpit equipment, and skill in determining the distance to the ground must be reestablished. A.R.H.

N78-16616# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: BIOMEDICAL AND BEHAVIORAL SCIENCES, NO. 20
17 Jan. 1978 56 p refs Transl. into ENGLISH from various Russian journal articles
(JPRS-70486) Avail: NTIS HC A04/MF A01

The history of environment protection in the U.S.S.R. is related with particular emphasis on the control of atmospheric air pollution. Test equipment is described for measuring the toxic hazards associated with polymerization and the effects of using polymers in construction, and in every day life. Other topics addressed include: a comparison of the vitamin supplements used in hog feed in Bulgaria and the U.S.; food additives for livestock in the U.S.S.R.; water quality in reservoirs; and health education in the Soviet Union. A.R.H.

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N78-16617 Arizona State Univ., Tempe.
SELF-REFERENT BEHAVIOR AS A FUNCTION OF LEADER-LED GROUPS Ph.D. Thesis
Roger Bownds Allen 1977 84 p
Avail: Univ. Microfilms Order No. 77-22440

Whether or not high levels of anxiety or the absence of a leader in a group affect the number of selfreferent statements made in a discussion group were investigated. The population of the study consisted of 40 female undergraduate students. The high and low trait anxious groups were assigned to leaderled and leaderless conditions. A videotaped model designed to increase self-referent statements was shown to all four experimental groups. Each group met for two 50 minute discussion sessions in which they talked about how they thought and felt about themselves as students. Audiotape recordings of the eight experimental sessions were made. The results indicate that neither high anxiety nor the absence of a leader had a significant effect on the number of verbalizations of self-referent statements. Dissert. Abstr.

N78-16618# Utah Univ., Salt Lake City. Dept. of Computer Science.
SENSORY INFORMATION PROCESSING Final Technical Report, 1 Jul. 1976 - 31 Mar. 1977
Thomas G. Stockham, Jr. Apr. 1977 117 p refs
(Contract DAHC15-73-C-0363)
(AD-A047200; UTEC-CSC-77-118) Avail: NTIS HC A06/MF A01 CSCL 09/4

Section I of this report discusses the theoretical underpinnings of a new mathematical model describing some of the perceptual characteristics of human sensory information processing. While much of the mathematics of the proposed model is explained here, experimental testing and verification has yet to take place. This work will continue to be pursued under alternate funding. Section II discusses in detail the background considerations necessary to understand the problems of removing atmospheric turbulence blur from images. This area of research is currently in transition from the stage of artificial computer models, to the stage of working with the simplest real data, i.e. case of a point light source, a star, viewed through the earth's atmosphere. Section III reports the background and progress to date on building the tools necessary for an image understanding system. These

tools as described were incorporated into a manual image understanding system designed to do analysis by synthesis. The system handles two-dimensional single objects on non-textured backgrounds, but only at the level of a trial testbed. Necessary next steps in developing a working system are outlined. GRA

N78-16619# Stanford Univ., Calif. Inst. for Mathematical Studies in the Social Sciences.
KNOWLEDGE-BASED ADAPTIVE CURRICULUM SEQUENCING FOR CAI: APPLICATION OF A NETWORK REPRESENTATION
Keith T. Wescourt, Marian Beard, and Laura Gould 20 Sep. 1977 17 p refs
(Contracts N00014-76-C-0165; N00123-75-C-1528)
(AD-A047090; TR-288) Avail: NTIS MF A01 CSCL 05/9

One aspect of tutoring skills for technical subjects is individualized, adaptive sequencing of the problems given to students as learning exercises. A Curriculum Information Network (CIN) describes the relationships between the problems in a CAI curriculum and the concepts and skills that they are intended to teach. It is a basis for selecting problems for each student with respect to his evolving knowledge of those concepts and skills. This paper describes the application of a semantic network to represent the complex interrelationships among the skills in a CIN for the BASIC Instructional Program, a CAI problem-solving laboratory for introductory programming in the BASIC language. The semantic network is used in drawing complex inferences about the student's state of knowledge and the problems that are appropriate to present to him. Such inferences enable more skillfull problem sequencing by the CAI system. Author (GRA)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N78-16620*# SRI International Corp., Menlo Park, Calif.
STUDY TO DESIGN AND DEVELOP REMOTE MANIPULATOR SYSTEMS Annual Report, 1 Aug. 1976 - 30 Nov. 1977
J. W. Hill and J. K. Salisbury, Jr. Nov. 1977 121 p refs
(Contract NAS2-8652; SRI Proj. 4055)
(NASA-CR-152092; AR-2) Avail: NTIS HC A06/MF A01 CSCL 05H

A description is given of part of a continuing effort both to develop models for and to augment the performance of humans controlling remote manipulators. The project plan calls for the performance of several standard tasks with a number of different manipulators, controls, and viewing conditions, using an automated performance measuring system; in addition, the project plan calls for the development of a force-reflecting joystick and supervisory display system. Author

N78-16621# Advisory Group for Aerospace Research and Development, Paris (France).
STUDIES ON PILOT WORKLOAD
Robert Auffret, ed. (Centre d'Essais en Vol, Bretigny-sur-Orge, France) Nov. 1977 125 p refs Partly in ENGLISH and FRENCH Presented at the Aerospace Med. Panel Specialists' Meeting, Cologne, 18-22 Apr. 1977
(AGARD-CP-217; ISBN-92-835-0205-1) Avail: NTIS HC A06/MF A01

The different variables which can influence human performance during the operational use of helicopters or other aircraft having high acceleration loads are assessed to quantify the sum of work which can be provided at each moment during flight. 4 For individual titles, see N78-16622 through N78-16632.

N78-16622# Italian Air Force Medical Service H. Q., Rome.
WORKLOAD AND OPERATIONAL FATIGUE IN HELICOPTER PILOTS
Gaetano Rotondo *In* AGARD Studies on Pilot Workload Nov. 1977 11 p refs (For availability see N78-16621 07-54)
Avail: NTIS HC A06/MF A01

The possible causes of the operational fatigue to which flight crews are subject during the performance of their duties are reviewed. The influence of the physical, psychic, and emotive components of the stress factor associated with the professional activities of helicopter pilots are analyzed and their effects in the genesis of flight fatigue is assessed. On the basis of this analytical survey, it is possible to conclude that the piloting of helicopters involves a psycho-physical workload that is not inferior to the one experienced by the pilots of faster and more powerful aircraft. Author

N78-16623# Army Aeromedical Research Lab., Fort Rucker, Ala. Aviation Psychology Div.
VISUAL WORKLOAD OF THE COPILOT/NAVIGATOR DURING TERRAIN FLIGHT
Michael G. Sanders, Mark A. Hofmann, Ronald R. Simmons, and J. Nicholas DeBonis *In* AGARD Studies on Pilot Workload Nov. 1977 9 p refs (For availability see N78-16621 07-54)
Avail: NTIS HC A06/MF A01

A high speed camera and a modified eye mark recorder were used to examine the oculomotor performance of the navigator/copilot during various tasks involved in nap-of-the earth, contour, and low level flight of a UH-1H helicopter. The visual performance was examined during (1) visual time inside the cockpit on flight and engine instruments; (2) time inside the cockpit on the map and other navigational aids; and (3) time outside the cockpit in various windscreen sectors. A visual free time task was utilized to determine the amount of visual time the navigator had available, during flight over the prescribed course, for a nonflight related task. The data indicate that the navigator's normal workload was demanding; the visual free time task was utilized only 3% of the total time. The data also indicate that the duty of navigating required 92.2% of the copilots total visual time while the engine and flight instruments were utilized only 4% of the time. These data are discussed in relation to the copilot's specified duties. Author

N78-16624# Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.
IN-FLIGHT RECORDING OF HELICOPTER PILOT ACTIVITY
E. J. Lovesey *In* AGARD Studies on Pilot Workload Nov. 1977 11 p refs (For availability see N78-16621 07-54)
Avail: NTIS HC A06/MF A01

A fully portable cine camera fitted with a wide angle lens was used to record pilots' head and hand movements in 6 different helicopters and 2 fixed wing aircraft types during nap-of-the-earth, low level and other flight phases. Apart from highlighting problem areas in the cockpit, the film records show that activity patterns depend more upon the flight profile than upon the helicopter type or the individual pilot. Subsequent film analysis has shown that the pilot time tends to increase with decreasing height above the ground. During nap-of-the-earth tactical flying, a pilot may spend over a third of the time looking inside the cockpit at maps, instruments and radios. This is precisely the time when he needs to spend the maximum time looking outside to detect and evade potential hazards such as wires, trees, enemy positions etc. Reasons for the apparently paradoxical behaviour and the effect upon pilot work-load are discussed. Typical pilot activity patterns are presented, together with an example of how poor cockpit design can obviously increase work-load and reduce efficiency. Author

N78-16625# Army Aeromedical Research Lab., Fort Rucker, Ala. Aviation Psychology Div.
THE ASSESSMENT OF ROTARY WING AVIATOR PRECISION PERFORMANCE DURING EXTENDED HELICOPTER FLIGHTS
Michael A. Lees, Kent A. Kimball, and Lewis W. Stone *In* AGARD Studies on Pilot Workload Nov. 1977 13 p refs (For availability see N78-16621 07-54)
Avail: NTIS HC A06/MF A01

Man machine system performance during a five day extended flight was evaluated with emphasis on the changes in pilot performance and aircraft stability during the stabilized 3-ft precision hover maneuver. Changes in subjective ratings of fatigue and flight performance and in the measurement of auditory reaction time are also discussed. Data obtained suggest the occurrence

of a learning effect across the first day of extended flight. The most stable hover performance was observed during the second flight day. By the third flight day, pilots attempted to maintain high quality precision hovers through an increase in the number of control inputs. On the fourth day of flight the pilots have shifted their control technique from active control of the helicopter to a more passive strategy of responding to observed error. The subjective rating scales demonstrate a progressive increase in the rated levels of fatigue between and within flight days. This increase in the level of fatigue corresponds to a general decrease in the ratings of flight performance. Author

N78-16626# Centre d'Essais en Vol, Bretigny-sur-Orge (France).
EVALUATING THE WORK LOAD OF HELICOPTER PILOTS. IN-FLIGHT RECORDINGS OF HEART RATE AND CARDIAC ARRHYTHMIA [EVALUATION DE LA CHARGE DE TRAVAIL DES PILOTES D'HELICOPTERES: ENREGISTREMENTS EN VOL DE LA FREQUENCE ET DE LA VARIABILITE DUE RYTHME CARDIAQUE]
Bernard Vettes *In* AGARD Studies on Pilot Workload Nov. 1977 13 p refs Partly in FRENCH and ENGLISH (For availability see N78-16621 07-54)
Avail: NTIS HC A06/MF A01

In-flight recordings were made of the heart rate and cardiac arrhythmia in four helicopter test pilots during increasingly difficult ILS approaches. Five types of tasks were identified, each task being repeated five times during the same flight. An analyses of the data obtained indicates an increase of heart rate with low concommitant rhythm variations, especially if the subject had a greater number of variations when at rest. This increase of cardiac rhythm is exacerbated by the addition of external function factors (turbulence). The influence of apprehension is evidenced by a sensible decrease in heart rate during successive repetitions of the same task. The inclusion of subjective criteria can provide some useful information. A study of arrhythmia appears to be a better measure than the instantaneous heart rate; however, an exact relationship between these parameters and the aviator's workload can not yet be affirmed. Transl. by A.R.H.

N78-16627# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehring.
A STUDY ON PILOT'S WORKLOAD IN HELICOPTER OPERATION UNDER SIMULATED IMC EMPLOYING A FORWARD LOOKING SENSOR
R. Beyer *In* AGARD Studies on Pilot Workload Nov. 1977 11 p refs (For availability see N78-16621 07-54)
Avail: NTIS HC A06/MF A01

Various measures of pilot workload are known which are presently applied to human engineering investigations. It is difficult, however, to find a measure which has proved to be universally applicable and adequately validated. Measures tailored to a specific application may be less flexible but can provide relevant and sufficient information on pilot workload. Some aspects of workload measurement are discussed, and some workload measurements and the results are presented by referring to flight tests with advanced displays for the helicopter. Author

N78-16628# School of Aerospace Medicine, Brooks AFB, Tex. Crew Technology Div.
AIRCREW FATIGUE IN NONSTOP, TRANSOCEANIC TACTICAL DEPLOYMENTS
William F. Storm, Bryce O. Hartman, and Donald L. Makalous *In* AGARD Studies on Pilot Workload Nov. 1977 7 p refs (For availability see N78-16621 07-54)
Avail: NTIS HC A06/MF A01

Stress and fatigue were evaluated in F-4D crews before and after flying nonstop, transoceanic deployments from New Mexico to Germany and return. The measurement battery consisted of subjective fatigue ratings, self ratings of fitness to fly, sleep logs, and biochemical analyses of urine samples for norepinephrine, epinephrine, 17-hydroxycorticosteroids, urea, sodium, and postassium. The magnitude and the consistency of behavioral and physiological changes indicated the occurrence of mild fatigue immediately after both flights. The fatigue was acute and was ameliorated by one uninterrupted sleep period. Author

N78-16629# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.
ENDOCRINE-METABOLIC COST OF PILOTING F-104 G AIRCRAFT
Hans M. Wegmann, Reinhold Hermann, and Paul Kuklinski *In* AGARD Studies on Pilot Workload Nov. 1977 4 p refs (For availability see N78-16621 07-54)
Avail: NTIS HC A06/MF A01

Metabolic endocrinological aspects of flight stress were studied in student pilots during a training course for the F-104 G. All of these were already experienced jet pilots. Responses to flying were evaluated by comparing pre- and postflight levels of blood constituents, including 11-hydroxycorticosteroids, glucose, adenosinetriphosphate, cholesterol, and the activity of three cell enzymes (MDH, GOT, GPT). From the results the following conclusions were obtained: 1. Flying the F-104 G caused significant changes of most parameters. 2. The blood constituents differed in their work-load sensitivity: 11-OHCS, GPT, and MDH proved to be the most sensitive, GOT, cholesterol, and ATP the most insensitive parameters for the load. Blood glucose does not seem to be an unequivocal variable to measure workload. Reviewing the pertinent literature and comparing the figures with those obtained from studies with standardized stressors, the operational significance of the results are discussed. Author

N78-16630# Dunlap and Associates, Inc., La Jolla, Calif.
METHODS TO ASSESS PILOT WORKLOAD AND OTHER TEMPORAL INDICATORS OF PILOT PERFORMANCE EFFECTIVENESS
Clyde A. Briltson *In* AGARD Studies on Pilot Workload Nov. 1977 7 p refs (For availability see N78-16621 07-54)
Avail: NTIS HC A06/MF A01

A systematic approach to define, measure and describe how certain pilot-related variables influence carrier landing performance during sustained operations is outlined. Previous exploratory research on the interrelations between psychophysiological variables, pilot experience and performance is described. Pilot work activity, mood and sleep are identified as indicators of a pilot's temporal state of readiness. A field study design and techniques to measure and describe temporal readiness during prolonged flight operations are provided to demonstrate the methodology in an operational environment. Potential applications of the research are discussed along with the future role of temporal, psychological and other moderator variables in estimating pilot flight status. Author

N78-16631# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Hamburg (West Germany). Inst. fuer Flugmedizin.
SUBJECTIVE RATINGS OF FLYING QUALITIES AND PILOT WORKLOAD IN THE OPERATION OF A SHORT HAUL JET TRANSPORT AIRCRAFT
K. Steininger *In* AGARD Studies on Pilot Workload Nov. 1977 12 p refs (For availability see N78-16621 07-54)
Avail: NTIS HC A06/MF A01

A representative sample of pilots employed by an airline operating a short haul jet transport aircraft assessed the acceptability of the cockpit layout and instrumentation, the handling quality, and the feasibility of the system operation in regard to the pilots workload. The assessment consisted of two parts: (1) a questionnaire of 82 fixed items being answered on a 7 step rating scale, (2) a semi-structured interview concerning 19 items, being answered on tape recorder. The justification to apply subjective ratings as a scientific method, instead of measuring objectively the physiological, and psychological reactions of the pilot is to be seen in the output: Critical points and favourable capabilities of the man machine system can be evaluated economically and objectively, provided there is a carefully chosen questionnaire and interview strategy, a well established rating scale, and a sufficient sample of persons for statistical evidence of the data. Author

N78-16632# Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).
SUBJECTIVE STRESS ASSESSMENT AS A CRITERION FOR MEASURING THE PSYCHOPHYSICAL WORKLOAD ON PILOTS

Hans-Peter Goerres *In* AGARD Studies on Pilot Workload Nov. 1977 8 p refs (For availability see N78-16621 07-54) Avail: NTIS HC A06/MF A01

The psychophysiological workload induced by an activity depends not only on the duration and intensity of stressing stimuli, but also upon intra-individual factors in the stressed subject itself (physical features, functioning of sensory organs, vegetative status, and present state of health as a prerequisite to physical performance; job-related knowledge, abilities, skills, need for achievement, experience, emotional stress resistance as psychic and mental determinants of strain). The results obtained by using standardized interviews and questionnaires to assess these psychophysiological strain parameters in 217 pilots of various type aircraft used by the German Federal armed forces are presented. Author

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N78-16633*# RCA Government and Commercial Systems, Camden, N. J.

TRADE-OFF STUDY OF DATA STORAGE TECHNOLOGIES Final Report

R. V. Kadyszewski Nov. 1977 132 p refs

(Contract NAS5-24170)

(NASA-CR-156672) Avail: NTIS HC A07/MF A01 CSCL 09B

The need to store and retrieve large quantities of data at modest cost has generated the need for an economical, compact, archival mass storage system. Very significant improvements in the state-of-the-art of mass storage systems have been accomplished through the development of a number of magnetic, electro-optical, and other related devices. This study was conducted in order to do a trade-off between these data storage devices and the related technologies in order to determine an optimum approach for an archival mass data storage system based upon a comparison of the projected capabilities and characteristics of these devices to yield operational systems in the early 1980's. Author

N78-16634 Illinois Univ., Urbana-Champaign.

BURSLOGIC: DESIGN AND ANALYSIS OF LOGIC CIRCUITRY TO PERFORM ARITHMETIC ON DATA IN THE BURST FORMAT Ph.D. Thesis

Leon Clemens Tietz 1977 70 p

Avail: Univ. Microfilms Order No. 77-26766

Designs for arithmetic processors with input and output data both in the Burst format were studied. An additional requirement was that these designs be constructible from readily available logic circuits such as TTL SSI and MSI and be competitive on both a cost and performance basis with the Block Sum Register (BSR) techniques first proposed for Burst Processing. The result is a family of arithmetic processors based on a design for adding Bursts known as the Perverted Adder (PA). The PA is a full adder and a flip-flop connected with the sum output of the full adder fed back to the carry input via the flip-flop. This simple circuit performs Burst addition. However, the output Bursts are uncompacted, i.e., the ones are no longer adjacent to one another, whereas BSR designs output compacted Bursts. Dissert. Abstr.

N78-16635 Illinois Univ., Urbana-Champaign.

MEMORY ORGANIZATIONS AND THEIR EFFECTIVENESS FOR MULTIPROCESSING COMPUTERS Ph.D. Thesis

Faye Alaye Briggs 1977 203 p

Avail: Univ. Microfilms Order No. 77-26637

Organizations of interleaved multimodule semiconductor memories were studied to facilitate accessing of memory words by parallel-pipelined multiple instruction stream processors. All memory modules are assumed to be identical and are characterized by the address cycle (address hold time) and memory cycle of a and c time units respectively. A total of N (=2n) memory modules are arranged such that there are l(=2b) lines for addresses and m(=2n-b) memory modules per line. For a parallel-pipelined processor of order (s, p), which consists of p parallel processors each of which is a pipelined processor with s degrees of multiprogramming, there can be up to s-p memory requests in each instruction cycle. The memory interference problems which arise in such systems were investigated. Dissert. Abstr.

N78-16636 Iowa Univ., Iowa City.

A MULTIPLE MICROPROCESSOR SIMULATOR Ph.D. Thesis

Donald Eugene Chapman 1977 125 p

Avail: Univ. Microfilms Order No. 77-25975

The viability of a multiple microprocessor simulator was investigated. A modular PL/1 program was written which can simulate systems composed of several microprocessors which may be dissimilar. The microprocessor specific program modules may be substituted to allow the simulation of any eight bit sliced microprocessor; however, the compiled version of this simulator allows the choice among the Intel 8008, Intel 8080, Motorola 6800, and the Fairchild F8 microprocessors. The microprocessors are modeled using vertical microprogramming in the PL/1 language. The simulator allows linking of microprocessors within the system both by port to port programmed transfers and also by shared main memory. The simulator allows study of concurrent operations of microprocessors by means of interleaved sequential mode of simulation with logging of accurate timing information. The simulator presents the user with a detailed trace of the operations internal to the microprocessors. Dissert. Abstr.

N78-16637 Case Western Reserve Univ., Cleveland, Ohio.

A MICROPROCESSOR-BASED DATA ACQUISITION AND PROCESSING SYSTEM FOR STUDYING THE KINEMATICS OF LABOR Ph.D. Thesis

Chin-Hu Feng 1977 123 p

Avail: Univ. Microfilms Order No. 77-18819

The design and development of a microprocessor-based data acquisition system and its considerations are presented. This system is capable of continuously and simultaneously monitoring cervical dilation and fetal descent as well as fetal heart rate and intra-uterine pressure during labor and delivery. The system is programmable so that system flexibility and versatility are assured. Major data acquisition routines are provided in the present system. Provisions of measurement calibration, data identification, interrupt handling, and system malfunction self-checking are also included. A program for the on-line recognition of uterine contraction onset time, peak time, end time, and interval is developed on a PDP-11/45. A recognition technique using the first order difference equation concept is developed. Results from 33 IUP files each 768 seconds in length show close correlation between machine recognition of uterine contractions and the visual recognition of them by a physician. In limited experimental

work the classification accuracy of this method was remarkable. Dissert. Abstr.

N78-16638*# Teledyne Brown Engineering, Huntsville, Ala. Systems Div.
LISTING OF DATA SYSTEMS ELEMENTS AUTHORITIES
Jul. 1977 58 p
(Contract NAS8-31488)
(NASA-CR-150527; SD-77-MSFC-2111) Avail: NTIS HC A04/MF A01 CSCL 09B

The NASA personnel have a need to be aware of and to interact with key technical experts in all areas of data systems. This report presents a partial listing (names, addresses and telephone numbers) of individuals known to be authorities in selected areas of data systems of interest to NASA. The listings are based primarily on recent publications by the named individuals. Author

N78-16639*# Teledyne Brown Engineering, Huntsville, Ala. Systems Div.
DATA SYSTEMS ELEMENTS TECHNOLOGY ASSESSMENT AND SYSTEM SPECIFICATIONS, ISSUE NO. 1
15 Jun. 1977 375 p refs
(Contract NAS8-31488)
(NASA-CR-150526; SD-77-MSFC-2104) Avail: NTIS HC A16/MF A01 CSCL 09B

The ability to satisfy the objectives of future NASA Office of Applications Programs is dependent on technology advances in a number of areas of data systems. The technology of end-to-end data systems (space generator elements through ground processing, dissemination, and presentation, is examined in terms of state of the art, trends, and projected developments in the 1980 to 1985 timeframe. Capability is considered in terms of elements that are either commercially available or that can be implemented from commercially available components with minimal development. Author

N78-16640*# Operations Research, Inc., Silver Spring, Md.
SPACELAB OUTPUT PROCESSING SYSTEM ARCHITECTURAL STUDY Final Report
8 Dec. 1977 233 p refs
(Contract NAS5-23438)
(NASA-CR-156679) Avail: NTIS HC A11/MF A01 CSCL 09B

Two different system architectures are presented. The two architectures are derived from two different data flows within the Spacelab Output Processing System. The major differences between these system architectures are in the position of the decommutation function (the first architecture performs decommutation in the latter half of the system and the second architecture performs that function in the front end of the system). In order to be examined, the system was divided into five stand-alone subsystems; Work Assembler, Mass Storage System, Output Processor, Peripheral Pool, and Resource Monitor. The work load of each subsystem was estimated independent of the specific devices to be used. The candidate devices were surveyed from a wide sampling of off-the-shelf devices. Analytical expressions were developed to quantify the projected workload in conjunction with typical devices which would adequately handle the subsystem tasks. All of the study efforts were then directed toward preparing performance and cost curves for each architecture subsystem. Author

N78-16641# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
A LAYERED VIRTUAL MEMORY MANAGER M.S. Thesis
Andrew Halstead Mason Hanscom AFB, Mass. ESD May 1977 136 p refs
(Contract F19628-74-C-0193; ARPA Order 2641)
(AD-A046613; MIT/LCS/TR-177; ESD-TR-77-250) Avail: NTIS HC A07/MF A01 CSCL 09/2

This thesis presents a specification for the Multics virtual memory manager. The virtual memory manager is that part of the operating system which coordinates the usage of physical memory and which manages the bindings between logical memory and physical memory. In the case of Multics, physical memory is composed of fixed-length blocks called frames and logical memory consists of segments, representing sets of frames. The original specification is now obsolete because it describes an overly complicated structure. The specification described here compatibly updates the functionality of the Multics virtual memory manager, simplifies the requisite structure, and addresses resource control problems. The specification is in the form of a model, using the methodologies of type extension and layers of abstraction. These methodologies provide the tools to develop a precise model structure, which is capable of handling the intricacies of resource control. The end result is organizational simplicity, certifiability, and comprehensibility. GRA

N78-16642# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
A SIMPLE AND FLEXIBLE SYSTEM INITIALIZATION MECHANISM M.S. Thesis
Allen William Luniewski Hanscom AFB, Mass. ESD May 1977 105 p refs
(Contract F19628-74-C-0193; ARPA Order 2641)
(AD-A046612; MIT/LCS/TR-180; ESD-TR-77-149) Avail: NTIS HC A06/MF A01 CSCL 09/2

This thesis presents an approach to system initialization which is simple and easy to understand and, at the same time, is versatile in the face of configuration changes. This thesis considers initialization of a layered system. The initialization mechanism is built upon three key concepts: existence of a minimal configuration, a core image of the system and dynamic reconfiguration. By assuming that the system will be running on the minimal configuration we generate a core image of the base layer of the system which, when loaded into core on any viable configuration, produces an operable base layer. As higher layers of the system are initialized, dynamic reconfigurations of the lower layers are invoked to cause the system to run on the configuration actually present. The thesis also considers the problems one might encounter in implementing the many dynamic reconfigurations required by this approach to system initialization. Author (GRA)

N78-16643# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
MEASUREMENT OF COMPUTER USER SATISFACTION M.S. Thesis
Sammy Pearson Aug. 1977 329 p refs
(AD-A046549; AFIT-CI-78-1) Avail: NTIS HC A15/MF A01 CSCL 09/2

User satisfaction was considered to be an important indicator of the effectiveness of the Electronic Data Processing (EDP) activity within an organization. The purpose of this research was to develop the means to measure this indicator. User satisfaction was defined as the sum of feelings or affective responses to distinguishable factors of computer-based information products and services that are provided within the organization. Thirty-nine factors that influence user satisfaction were identified. The completeness of this factor set was substantiated by empirical test results based upon the interviews of 32 middle management users in 8 organizations. The semantic differential methodology was adapted to develop a measurement instrument based on the 39 factors. An evaluation of the instrument confirmed the necessary properties of reliability and validity. The results indicated that the instrument could be used to measure user satisfaction successfully. Author (GRA)

N78-16644# Army Research Office, Research Triangle Park, N. C.
PROCEEDINGS OF THE 1977 ARMY NUMERICAL AND COMPUTERS ANALYSIS CONFERENCE Interim Technical Report
Nov. 1977 577 p refs Conf. held at Math. Res. Center, Wisconsin Univ., Madison, 30-31 Mar. 1977
(AD-A046552; ARO-77-3) Avail: NTIS HC A05/MF A01 CSCL 09/2

The theme of the 1977 Army Numerical Analysis and Computers Conference was The Numerical Solution of Partial Differential Equations. Many of the papers presented stressed ideas related to this theme. Addresses delivered on this theme were Survey of Recent Techniques for Solving Hyperbolic Equations, Progress in the Calculation of Two and Three Dimensional Boundary Layers, Solution of Partial Differential

Equations on Vector Computers and Numeric Computation Facilities of a Common Programming Language for DOD. GRA

N78-16645# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
AN APPROACH TO DEDUCTIVE QUESTION-ANSWERING
Raymond Reiter Sep. 1977 169 p refs
(Contract N00014-77-C-0378; ARPA Order 3414)
(AD-A046550; BBN-3649) Avail: NTIS HC A08/MF A01 CSCL 09/2

This paper is concerned with a variety of issues which arise in deductive question-answering. Its principal concern is with the design of a retrieval system which combines current techniques for query evaluation on relational data bases with a deductive component in such a way that the interface between the two is both clean and natural. More specifically, a suitably designed theorem prover sweeps through the intensional data base (i.e., the set of general facts about the domain of interest), extracting all information relevant to a given query. The end result of this sweep is a set of queries, each of which is then evaluated over the extensional data base (i.e., the set of specific facts). The union of the answers returned from each of these queries is the set of answers to the original query. This paper also addresses some issues on how best to structure a data base. Part of this paper is concerned with issues of integrity. Finally, an approach for compiling the intensional data base is proposed. GRA

N78-16646# RAND Corp., Santa Monica, Calif.
RITA REFERENCE MANUAL Interim Report
R. H. Anderson, Margaret Gallegos, J. J. Gillogly, R. Greenberg, and R. Villanueva Sep. 1977 82 p
(Contract DAHC15-73-C-0181; ARPA Order 189)
(AD-A046627; R-1808-ARPA) Avail: NTIS HC A05/MF A01 CSCL 09/2

A detailed reference manual for the RITA system, a set of computer programs which enable a user to develop user agents to perform such tasks as providing a simple interface to remote data systems. The system makes available a language for writing rules describing those agents, behavior and an operating environment in which the rules are interpreted. It also provides some heuristic modeling capability. The report describes the RITA concepts, keywords, and commands. A complete syntax chart for the system, with tables of reserved words and built-in functions, is also included, along with an illustrative example of a RITA rule set. GRA

N78-16647# Naval Research Lab., Washington, D. C.
THE IMPLEMENTATION OF AN OPERATING SYSTEM FOR A SHARED MICROCOMPUTER ENVIRONMENT M.S. Thesis
Stephen J. Carro and Barry L. Knouse Sep. 1977 199 p refs
(AD-A047129) Avail: NTIS HC A09/MF A01 CSCL 09/2

An implementation of a multiuser timeshared operating system for the Sycor 440 Clustered Terminal Processing System has been described. Utilizing an 8080 microprocessor, this system provides a virtual operating environment consisting of a console device, eight floppy disk drives, and up to 32 virtual floppy disk images on a five megabyte movable-head disk. In addition a Centronix serial printer is incorporated into the system as a dedicated device for any one of up to four concurrent users. The operating system supports utility programs including an editor, assembler, and debugger which facilitate microcomputer program development at the Naval Postgraduate School.
Author (GRA)

N78-16648# Naval Research Lab., Washington, D. C.
THE DEVELOPMENT OF A COBOL CALCULATOR FOR HIGH-PERFORMANCE BIT-SLICE MICROPROCESSORS M.S. Thesis
Elizabeth K. Conley and Ronald W. Modes Sep. 1977 112 p refs
(AD-A047128) Avail: NTIS HC A06/MF A01 CSCL 09/2

The design of a COBOL editor and interpreter is explored which uses simple, straightforward algorithms similar to the approach found in programmable calculators. The algorithms are designed to be implemented using the microinstructions of a high-performance bit-slice microprocessor. A possible machine design using a family of microprogrammable four-bit-slice bipolar circuits is outlined. Author (GRA)

N78-16649# Massachusetts Inst. of Tech., Cambridge. Computer Science Lab.
A STRUCTURE MEMORY FOR DATA FLOW COMPUTERS M.S. Thesis
William B. Ackerman Sep. 1977 129 p
(Contract N00014-75-C-0661)
(AD-A047026; MIT/LCS/TR-186) Avail: NTIS HC A07/MF A01 CSCL 09/2

A data flow computer is one which achieves enormous concurrency of instruction execution through a machine architecture that acts directly on a data dependency graph of the program. To handle arrays and data structures effectively a data flow computer must have access to a memory system which can handle large numbers of concurrent transactions. This thesis presents a design for such a memory. A cache mechanism is presented for improving the performance of the system, and a mechanism is given for using sequential-access devices such as shift registers as the memory medium. The memory system design uses the packet communication concept, in which the components of the system communicate only through the transmission of fixed size packets of data. Author (GRA)

N78-16650# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A MINICOMPUTER/MICROPROCESSOR PROGRAMMING INTERFACE
Susan N. Landon 19 Sep. 1977 21 p
(Contract F19628-76-C-0002)
(AD-A047100; ETS-18; ESD-TR-77-232) Avail: NTIS HC A02/MF A01 CSCL 09/2

A unique solution to the problem of a microcomputer development system is described here. Special-purpose hardware was built for communications between the Motorola 6800 microprocessor and the MODCOMP IV computer. This hardware allows for the transmission of 8 bits of data in either direction at the initiative of the microprocessor. Computer programs were then written for both the microprocessor and the minicomputer to permit the use of the microprocessor Loader and Assembler on source and binary program files stored on the MODCOMP. This system allows the programmer to take advantage of the editing, disc storage and high speed line printer capabilities of the MODCOMP while using the actual M6800 Loader, Assembler, and MPU. Sufficiently fast and reliable data transfer rates were achieved such that this system has provided us with an effective development tool. Further, by additions to the programs in the two machines, this interface can easily be expanded to include the M6800 Macro Assembler and Link Loader. Author (GRA)

N78-16651# Illinois Univ., Urbana. Dept. of Computer Science.
BURSTLOGIC: DESIGN AND ANALYSIS OF LOGIC CIRCUITRY TO PERFORM ARITHMETIC ON DATA ON THE BURST FORMAT Ph.D. Thesis
Leon Clemens Tietz May 1977 75 p refs
(Contract N00014-75-C-0982)
(AD-A046974; UIUCDCS-R-77-895; UILU-ENG-77-1749) Avail: NTIS HC A04/MF A01 CSCL 09/2

A family of Processors has been developed to perform arithmetic on data in the Burst Format. The common building block of these circuits is a simple finite state machine called the Perverted Adder (PA) which performs BURST addition. The interconnection of PAs in a tree formation with some additional circuitry produces a Burst multiplier or divider. A PA CPU has been constructed to demonstrate these PA designs.
Author (GRA)

N78-16652# Mitre Corp., Bedford, Mass.
MITRE PREPROCESSOR
D. R. Bungard Nov. 1977 89 p refs
(Contract F19628-76-C-0001; AF Proj. 6290)
(AD-A047317; MTR-3387; ESD-TR-77-257) Avail: NTIS HC A05/MF A01 CSCL 09/2

A high-speed, special-purpose preprocessor has been designed for the GEODSS (Ground-based Electro-Optical Deep Space Surveillance) system during the experimental test and evaluation phase of this program. The preprocessor is part of snapshot MTI technique presently being tested and evaluated at the GEODSS Experimental Test Site (ETS). The preprocessor provides the interface between a low light level TV sensor and the MITRE

multi-minicomputer processor. The primary functions performed by the preprocessor are: input signal processing, buffer memory data storage, output data processing, and preprocessor and TV sensor timing and control. This report provides a detailed system level description of the preprocessor concept, function and implementation. Detailed schematics and logic diagrams of the preprocessor are documented separately. GRA

N78-16653# Naval Research Lab., Washington, D. C.
A MICROPROCESSOR CONTROLLED AUTOMATIC DATA LOGGING SYSTEM, ADL M.S. Thesis
John David Casko Jun. 1977 124 p refs
(AD-A047169) Avail: NTIS HC A06/MF A01 CSCL 09/2

This paper describes a digital, microprocessor controlled data acquisition system which optimizes man/machine communications. The processor provides digital feedback control, data collection over any number of channels (up to 8), 32 BIT floating point (7 significant digit) mathematics, and a variety of output formats. The main features of the device are the ability to work in any numerical unit desired by the user, mathematical noise filtering and automatic feedback control. The particular application under consideration is automatic data collection and angle-of-attack control of a subsonic wind-tunnel. Data are presented to demonstrate the data logging capabilities of the system. Author (GRA)

N78-16654# Naval Research Lab., Washington, D. C.
THE DEVELOPMENT OF A SEGMENTED MEMORY MANAGER FOR THE UNIX OPERATING SYSTEM WITH APPLICATIONS IN A MULTIPORTED MEMORY ENVIRONMENT M.S. Thesis
James M. ODell Sep. 1977 80 p refs
(AD-A047170) Avail: NTIS HC A05/MF A01 CSCL 09/2

This thesis reports the development of a segmented memory manager for the UNIX operating system on a PDP-11/50 minicomputer. Considered in detail is the application of this memory manager to data segment boundary alignment and system protection in a multiported memory configuration. Recommendations are provided for the integration of this operating system into the total Naval Postgraduate School Signal Processing and Display Laboratory Environment. Author (GRA)

N78-16655# Aerospace Corp., El Segundo, Calif. Advanced Programs Div.
FAULT-TOLERANT COMPUTERS FOR SPACECRAFT Final Report, Oct. 1976 - Feb. 1977
H. Hecht 6 Jun. 1977 49 p refs
(Contract F04701-76-C-0077)
(AD-A041483; TR-0077(2161-02)-1; SAMSO-TR-77-105) Avail: NTIS HC A03/MF A01 CSCL 09/2

Recent advances in micro-electronics and in computer architecture have led to renewed interest in fault-tolerant computers for spacecraft applications. The general field of fault-tolerant computers is surveyed, and concepts of static and dynamic redundancy, error detection by code or multiple processing, and the significance of low-level redundancy are explained. Prior efforts in the design of fault-tolerant computers for space applications are surveyed with processing capability, weight, and reliability estimates listed for a number of representative efforts. The SAMSO Fault-Tolerant Spaceborne Computer (FTSC) is the most current of these developments, and it is described in greater detail together with the proposed reliability test methodology for the prototype. Recent developments in reliability estimation, employment of microprocessors, and fault-tolerant software that are related to this field are briefly discussed. Author (GRA)

N78-16656# California Univ., Livermore. Lawrence Livermore Lab.
COMPARISON OF THE EXTENDED SET THEORY AND RELATIONAL APPROACHES TO DATA BASE MANAGEMENT
Edward W. Birss and Jeffry W. Yeh 12 Apr. 1977 21 p refs Presented at 3rd Intern. Conf. on Very Large Data Bases, Tokyo, 6-8 Oct. 1977
(Contract W-7405-eng-48)
(UCRL-79357; Conf-771007-1) Avail: NTIS HC A02/MF A01

The extended set model is compared with the relational model; the extended set model is found to be more general than the relational model, primarily because of the recursive definition of a set in extended set theory. This definition, and its ramifications, permit some interesting capabilities including data compaction, dynamic restructuring, and physically maintaining multiple updatable views of data. ERA

N78-16657# Sandia Labs., Albuquerque, N. Mex.
BARRIER DATA BASE USERS GUIDE
R. B. Worrell, D. J. Gould, and D. W. Wall Jun. 1977 50 p refs
(Contract EY-76-C-04-0789)
(SAND-76-0521) Avail: NTIS HC A03/MF A01

A special purpose data base for physical security barriers has been developed. In addition to barriers, the entities accommodated by the barrier data base include threats and references. A threat is established as a configuration of people and equipment which has been employed to penetrate a barrier. References are used to cite publications pertinent to the barriers and threats in the data base. Utilization and maintenance of the barrier data base is achieved with LIST, QUERY, ENTER, DELETE, and CHANGE commands which are used to manipulate the data base entities. ERA

N78-16658# Los Alamos Scientific Lab., N. Mex.
HELPER PROJECT Final Report
D. E. Schultz Feb. 1977 40 p
(Contract W-7405-eng-36)
(LA-6680-MS) Avail: NTIS HC A03/MF A01

The HELPER minicomputer hardware and software capabilities are throughly explained and critically reviewed. HELPER is a cost-effective assistant to the present CCF system. The recommendations are to assign specific types of tasks to HELPER and to study the resulting effects on CCF users. Improvements to the present HELPER hardware are also suggested. An extension patterned after the Ethernet system may be used in the future to obtain a higher data rate for those users who require this capability. ERA

N78-16659# National Bureau of Standards, Washington, D. C. Technology Div.
COPYRIGHT IN COMPUTER-READABLE WORKS: POLICY IMPACTS OF TECHNOLOGICAL CHANGE Final Report
Roy G. Saltman Oct. 1977 271 p refs
(Grant NSF SIS-74-14168)
(PB-272789/9; NBS-SP-500-17; LC-77-14143) Avail: NTIS HC A12/MF A01 CSCL 09B

The findings, recommendations, and conclusions of a policy-oriented, multi-disciplinary study of copyright in computer-readable works are reported. The foundations of copyright are examined for basic principles, and the theory of public goods is applied to develop the rationale for copyright protection. The judicial history of copyright in the twentieth century is reviewed with respect to advances in information technology. The impact of technological change on judicial decision-making in copyright is analyzed. The problem of transaction costs for copyrighted works is examined, and models of policymaking are developed. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N78-16660 Case Western Reserve Univ., Cleveland, Ohio.
AN ATTRIBUTE ACCESS PROBABILITY DETERMINATION PROCEDURE Ph.D. Thesis
Jon Dennis Clark 1977 209 p
Avail: Univ. Microfilms Order No. 77-25151

The efficient structure of a data base is crucial to the operation of an information processing system. Many algorithms were developed to select an efficient storage structure; all, however, depend on some expression of the level of activity of a given element or attribute in each request for data. The literature

and practice, unfortunately, has not provided much insight into the problem of attribute access probability determination in a manner which is not biased due to the actions of hardware and software support systems. The various types of bias are described, and current practices compared to the use of the new procedure in light of these biases. The basic thesis is: an organized and substantially automatable procedure for usage and access statistics (attribute access probability) collection can be defined which will operate on the computer programs used to access the files as well as inputs to them and outputs produced by them.
Dissert. Abstr.

N78-16661 California Univ., Los Angeles.
A COMPARATIVE STUDY OF THE EFFECTIVENESS OF TEAM INTERACTION IN COBOL PROGRAMMING LANGUAGE LEARNING Ph.D. Thesis
Ronald Steven Lemos 1977 385 p
Avail: Univ. Microfilms Order No. 77-23897

Individualistic programming encourages individual effort in completing programs, an ownership relationship with programs, and minimal interaction between programmers. Egoless programming encourages a restructured value system dictating that secretive programming is bad and that open, shared programming is good. Programmers view reading and critiquing each other's programs as being supportive of mutual future improvement. The seven intact classrooms were randomly assigned to the two treatment groups. Students in the experimental group were assigned to five different three-person teams during the quarter to read and critique (in writing) team member's a program listings prior to execution attempts. The control group receive no such treatment. The results suggest that the team activities more effectively contribute to increased COBOL proficiency, especially in writing programs, and more favorable general programming attitudes. Dissert. Abstr.

N78-16662 Pittsburgh Univ., Pa.
CONTROL ISSUES IN THE DEVELOPMENT OF A CONVERSATIONAL SIMULATION LANGUAGE Ph.D. Thesis
Sallie Sheppard Nelson 1977 214 p
Avail: Univ. Microfilms Order No. 77-23546

A prototype conversational simulation language, called CONSIM, was developed. The implementation was used as a vehicle to study the feasibility of conversational simulation, to test the design decisions, to establish the implementation problems, to explore the feasibility of implementation techniques, and to provide an environment in which to evaluate the utility of conversational simulation. The implementation of the prototype system in this study provides proof that conversational simulation is possible. From this experience conclusions regarding the complexity of the system, support for debugging aids, need for user guidance, system monitoring and state saving techniques, and new programming styles are presented. A scenario showing top-down development of a simple model is included.
Dissert. Abstr.

N78-16663 Utah Univ., Salt Lake City.
MODELING OF SOLIDS FOR THREE-DIMENSIONAL FINITE ELEMENT ANALYSIS Ph.D. Thesis
Bruce Eric Brown 1977 126 p
Avail: Univ. Microfilms Order No. 77-23425

The formulation of the finite element method was investigated to provide geometric criteria for evaluation of the model for analysis. A new technique was developed for deriving improved analysis models from the trivariate representation. Computer programs were implemented to demonstrate these ideas and four examples are included. Dissert. Abstr.

N78-16664 Arkansas Univ., Fayetteville.
A STUDY OF COMPUTATIONAL TECHNIQUES FOR ZERO-ONE POLYNOMIAL PROGRAMMING Ph.D. Thesis
Hiroo Sakamoto 1977 148 p
Avail: Univ. Microfilms Order No. 77-23350

A revised Lawler and Bell's algorithm was developed for solving nonlinear zero-one integer optimization problems. The algorithm is a combination of Balas' (additive) algorithm and the Lawler and Bell's algorithm. In the revised algorithm, variables are entered into the solution in a nonfixed order. The Balas' algorithm provides the empirical measure of infeasibility for every unassigned polynomial term when it is applied to the equivalent linear system. The variable which has the smallest empirical value of infeasibility is selected to enter the solution. The application of Balas' algorithm to the equivalent linear system provides a means of selecting variables intelligently so that the large number of iterations caused by the examination of variables in a fixed order in Lawler and Bell's algorithm can be eliminated. Dissert. Abstr.

N78-16665 Texas Univ., Austin.
DETERMINING THE CAPACITY OF UNSIGNALIZED INTERSECTIONS USING COMPUTER SIMULATION Ph.D. Thesis
Vivek Shankar Savur 1977 200 p
Avail: Univ. Microfilms Order No. 77-23029

A method for determining the capacity of unsignalized intersections, using a microscopic, situation-responsive computer simulation model, was developed. Capacity, which is the maximum traffic volume that can be accommodated at an intersection while maintaining a specified level of service, was related quantitatively to five subjectively-defined levels of service by identifying suitable performance indicators such as average queue delay, percent of vehicles required to stop, and percent of vehicles required to slow below 10 MPHR These indicators are computed routinely during the simulation process and can be used for evaluating the performance of existing or proposed unsignalized intersections operating under various traffic volumes and different types of control. Dissert. Abstr.

N78-16666 Ohio State Univ., Columbus.
A BINARY IMAGE ARRAY PROCESSOR: HARDWARE DESIGN AND LANGUAGE DEVELOPMENT Ph.D. Thesis
Craig Stuart Robinson 1977 275 p
Avail: Univ. Microfilms Order No. 77-24691

An alternative computing architecture representing a compromise between the high computational speed of an array processor, and the accompanying high cost. This special purpose hardware structure was successfully constructed and interfaced to a host general purpose computer. It emulates the operation of an array processor consisting of 16,384 processing elements, at a total parts cost of under $1000. Another problem encountered with the previous research is the lack of software transportability. A number of research institutions possess array processing capabilities, either through hardware or by simulation. However, any software sharing typically requires re-writing programs developed at one installation before they can be used at another installation. This situation is in complete contrast with the ease of transporting programs written, for example, in FORTRAN among an assortment of different serial processors. Dissert. Abstr.

N78-16667 Illinois Univ., Urbana-Champaign.
A UNIVERSAL LANGUAGE FOR CONTINUOUS NETWORK SIMULATION Ph.D. Thesis
Thomas Fred Runge 1977 160 p
Avail: Univ. Microfilms Order No. 77-26743

One of the principal advantages of digital computers over analog computers for simulation is their capability for high-level language interpretation. Consequently, it is possible to formulate models for digital simulation at a very high level, once an appropriate modeling language and translator exist. Previously network-oriented modeling languages were limited to narrow ranges of applications while widely applicable equation-oriented languages were unsuited for most network problems. A widely applicable and highly portable language for very high-level network modeling is now reported. Generalized connective effects are handled automatically. Arbitrary network elements can be defined by implicitly formulated ordinary differential and nondifferenttial equations. The language translator and numerical support are implemented in American National Standard FORTRAN. The language is described in detail and prospects for its further development are discussed. Dissert. Abstr.

N78-16668 California Univ., Los Angeles.
PROPERTIES OF SYNTAX-DIRECTED TRANSLATIONS Ph.D. Thesis
Arthur R. Sorkin 1977 87 p
Avail: Univ. Microfilms Order No. 77-25344

A family of syntax-directed translation schemes was defined

previously and studied. These include the generalized syntax-directed translation (GSDT), syntax-directed translation (SDT), simple syntax-directed translation (SSDT), and the simple polish syntax-directed translation (SPSDT). Defined but not extensively studied was the scheme KGSDT. The GSDT and its restrictions perform their translations from the leaves to the root of the tree being translated. The KGSDT, on the other hand, can pass information down as well as up the tree. The KGSDT is an application of the ideas of Donald Knuth on attribute grammars to syntax-directed translation schemes. This is an investigation of the properties of KGDT's in relation to the other classes of formal languages and their associated automata. Also studied are some further properties of GSDT's. Dissert. Abstr.

N78-16669*# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering and Computer Science.
RELATIONSHIPS BETWEEN DIGITAL SIGNAL PROCESSING AND CONTROL AND ESTIMATION THEORY
Alan S. Willsky Jan. 1978 97 p refs
(Grant NGL-22-009-124; NSF GK-41647)
(NASA-CR-155504; ESL-P-792) Avail: NTIS HC A05/MF A01 CSCL 09B

Research directions in the fields of digital signal processing and modern control and estimation theory are discussed. Stability theory, linear prediction and parameter identification, system synthesis and implementation, two-dimensional filtering, decentralized control and estimation, and image processing are considered in order to uncover some of the basic similarities and differences in the goals, techniques, and philosophy of the disciplines.
Author

N78-16670# Saab-Scania, Linkoping (Sweden). Aerospace Div.
A COMPUTER GENERATED IMAGE SYSTEM FOR REAL TIME SIMULATION
Bo Samuelsson, Tommy Johansson, and Lars Gimstedt 1977 19 p Original contains color illustrations
(SAAB-TN71-Ae) Avail: NTIS HC A02/MF A01

A moderate cost computer driven display system giving a color television picture composed of 30 surfaces is described. Each surface is bounded by 4 edges of any slope and position, and the color and intensity can be varied within the color television spectrum. The entire picture is updated at 25 Hz and can be used in real-time simulation applications. Author

N78-16671*# Maryland Univ., College Park. Dept. of Computer Science.
A STUDY OF SYSTEMS IMPLEMENTATION LANGUAGES FOR THE POCCNET SYSTEM
Victor R. Basili and James W. Franklin 27 Aug. 1976 176 p refs
(Contract NAS5-22581)
(NASA-CR-156680) Avail: NTIS HC A05/MF A01 CSCL 09B

The results are presented of a study of systems implementation languages for the Payload Operations Control Center Network (POCCNET). Criteria are developed for evaluating the languages, and fifteen existing languages are evaluated on the basis of these criteria. Author

N78-16672# TRW Defense and Space Systems Group, Huntsville, Ala.
SREP. VOLUME 2: REVS USERS MANUAL Final Report
M. E. Dyer, L. J. Gunther, R. W. Smith, W. E. Benoit, P. N. Bergstresser, D. C. Bixler, W. G. Heckler, G. C. Hitt, and D. E. McQueen 1 Aug. 1977 422 p refs Revised
(Contract DASG60-75-C-0022)
(AD-A046572; TRW-27332-6921-026-Vol-2; Rev-A) Avail: NTIS MF A01 CSCL 09/2

For abstract, see N78-15735.

N78-16673# Naval Postgraduate School, Monterey, Calif.
A FINITE ELEMENT PREPROCESSOR FOR SAP IV AND ADINA M.S. Thesis
Adrian Earl Kibler, Jr. Sep. 1977 132 p refs
(AD-A046385) Avail: NTIS HC A07/MF A01 CSCL 09/2

The primary purpose of this thesis was to provide a method of checking the geometry and element connectivity input data for two finite element programs, ADINA and SAP IV. This preprocessor will accept the ADINA or SAP IV data deck, with minor modifications, and generate a graphical display of the finite element model. The display is an oblique orthographic projection, and any orientation may be specified. Several options are available: exploded plots, partial plots, node numbering, element numbering, and others. Elements with three nodes on the same edge are plotted with a continuous curve on each edge generated by an interpolated parabola. Displacement postprocessing capability also exists. Author (GRA)

N78-16674# Mitre Corp., Bedford, Mass.
PROGRAMMING LANGUAGES, STANDARDS, USE, AND SELECTION: AIR FORCE AND OTHER GOVERNMENT AGENCIES. VOLUME 1, ANALYSIS
P. L. Loring, E. A. Lamagna, and L. J. LaPadula Oct. 1977 138 p refs
(Contract F19628-76-C-0001)
(AD-A046616; MTR-3345-Vol-1; ESD-TR-77-143-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 09/2

Information related to computer programming languages was collected about U.S. Air Force systems and about activities at other government agencies during Phase II of the Air Force Systems Command High Order Language Standardization Program. An understanding of this experience in procuring, developing, and operating weapon and defense systems involving embedded computer resources is required in order to assist decision-making regarding standardization of programming languages for Air Force use. Facts were reported on 64 U.S. Air Force systems and on related programs at NASA, the FAA, and other government agencies. An analysis of this data is presented in Volume I, and system summaries are presented in Volume II. Author (GRA)

N78-16675# University of Southern Calif., Marina del Rey. Information Sciences Inst.
A PROOF RULE FOR FUNCTIONS
David R. Musser Oct. 1977 10 p refs
(Contract DAHC15-72-C-0308; ARPA Order 2223)
(AD-A046298; ISI/RR-77-62) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report gives a rule of inference which permits a natural form of reasoning about programs containing functions. The rule was obtained by modifying the function rule of Clint and Hoare to include a premise which requires consistency of preconditions and postconditions, and a premise which requires deterministic computation. Examples of use of the rule and versions tailored to the Pascal and Euclid languages are also given.
Author (GRA)

N78-16676# Federal COBOL Compiler Testing Service, Washington, D. C.
COBOL COMPILER VALIDATION SUMMARY REPORT
30 Nov. 1977 57 p
(AD-A047097; CCVS74-VSR245) Avail: NTIS HC A04/MF A01 CSCL 09/2

The purpose of this Validation Summary Report (VSR) is to identify individual COBOL Language elements whose implementation does not conform to American National Standard Programming Language COBOL, X3.23-1974, and to Federal Standard COBOL as adopted ,from the American National Standard by Federal Information Processing Standard 21-1 (FIPS PUB 21-1). This VSR for the Texas Instruments Advanced Scientific Computer Compiler Version 5.22 (OS Version 4.024) provides a consolidated summary of the results obtained from the validation of the subject compiler against X3.23-1974/FIPS PUB 21.1. The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies by level/module within X3.23-1974, a section relating the categories of discrepancies to each of the Federal levels of the language; and a detailed listing of discrepancies together with the tests which were failed. GRA

N78-16677# Naval Surface Weapons Center, White Oak, Md. Ordinance Systems Development Dept.
GENERALIZED MULTI-CHANNEL ANALYSIS PROGRAMS FOR THE DART (DIGITAL ANALYSIS IN REAL TIME) COMPUTER SYSTEM Final Report

Curtis A. Shively 2 Feb. 1977 53 p refs
(AD-A047011; NSWC/WOL/TR-77-3) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report describes software programs for a system of NOVA computers to accumulate multichannel input time samples and generate their Fourier transform coefficients in real time. Also described are programs to receive the DFT coefficients for further processing under a BASIC interpreter. Program listings and comments on usage are included. Author (GRA)

N78-16678# System Development Corp., Santa Monica, Calif.
SOFTWARE ACQUISITION MANAGEMENT GUIDEBOOK: SOFTWARE QUALITY ASSURANCE Technical Report, Jun. 1976 - Aug. 1977
George Neil and Harvey I. Gold Aug. 1977 95 p refs
(Contract F19628-76-C-0236)
(AD-A047318; SDC-TM-5772/001/03; ESD-TR-77-255) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report is one of a series of Software Acquisition Management guidebooks which provide information and guidance for ESD Program Office personnel who are charged with planning and managing the acquisition of command, control, and communications system software procured under Air Force 800 series regulations and related software acquisition management concepts. It provides guidance for establishing and implementing a software quality assurance program which it discusses in terms of Program Office quality assurance requirements, contractor quality assurance requirements, and software quality assurance at ESD. Special attention is given to: the relationship of quality assurance to other acquisition management disciplines; the integration of quality assurance requirements into the system acquisition process; the contractual aspects of quality assurance; monitoring the implementation of quality assurance requirements; and common problems and proposed solutions. GRA

N78-16679# Naval Postgraduate School, Monterey, Calif.
ALGOL-M. AN IMPLEMENTATION OF A HIGH-LEVEL BLOCK STRUCTURED LANGUAGE FOR A MICROPROCESSOR-BASED COMPUTER SYSTEM M.S. Thesis
John P. Flynn and Mark S. Moranville Sep. 1977 189 p refs
(AD-A047266) Avail: NTIS HC A09/MF A01 CSCL 09/2

The design and implementation of the ALGOL-M programming language for use on a microprocessor-based system is described. The implementation is comprised of two subsystems, a compiler which generates code for a hypothetical zero-address machine and a run-time monitor which executes this code. The system was implemented in PL/M to run on an 8080 microcomputer in a diskette-based environment with at least 20K bytes of user storage. Author (GRA)

N78-16680# Naval Research Lab., Washington, D. C.
A COMPARISON OF TWO ALGORITHMS FOR THE SIMULATION OF NON-HOMOGENEOUS POISSON PROCESSES WITH DEGREE-TWO EXPONENTIAL POLYNOMIAL INTENSITY FUNCTION M.S. Thesis
Michael Lelon Patrow Sep. 1977 123 p refs
(AD-A047164) Avail: NTIS HC A06/MF A01 CSCL 09/2

Two algorithms for generating a non-homogeneous Poisson process with log-quadratic intensity functions are implemented into computer programs and compared for relative speed, core storage requirements and fidelity. By simulating several cases of non-homogeneous Poisson processes with log-quadratic intensity functions it is shown that the Poisson-decomposition and gap statistic algorithm substantially reduce computation time from that required by an algorithm that uses a time-scale transformation of a homogeneous Poisson process. The experience gained from implementing the algorithm has led to several possibilities which are suggested for improving the efficiency of the Poisson-decomposition and gap statistic algorithm. GRA

N78-16681# Maryland Univ., College Park. Dept. of Computer Science.
ARTIFICIAL INTELLIGENCE PROGRAMMING LANGUAGES FOR COMPUTER AIDED MANUFACTURING
Chuck Rieger, Hanan Samet, and Jonathan Rosenberg Sep. 1977 52 p refs Sponsored in part by NBS
(Contract N00014-76-C-0477)
(AD-A047179; TR-595) Avail: NTIS HC A04/MF A01 CSCL 09/2

Eight Artificial Intelligence programming languages (SAIL, LISP, MICROPLANNER, CONNIVER, MLISP, POP-2, AL and QLISP) are presented and surveyed, with examples of their use in an automated shop environment. Control structures are compared, and distinctive features of each language are highlighted. A simple programming task is used to illustrate programs in SAIL, LISP, MICROPLANNER and CONNIVER. The report assumes reader knowledge of programming concepts, but not necessarily of the languages surveyed. Author (GRA)

N78-16682# California Univ., Livermore. Lawrence Livermore Lab.
MANAGER: A GENERATOR OF REPORTS ON THE EXPENDITURE OF SCIENTIFIC MANPOWER
David Lai 3 Mar. 1977 36 p refs
(Contract W-7405-eng-48)
(UCID-30152) Avail: NTIS HC A03/MF A01

The computer program MANAGER accepts monthly data on how the time of scientists within a division is allocated, updates a year-to-year summary file, and generates reports that give current and cumulative figures on that allocation of effort. The reports subdivide this effort according to scientists, tasks, events, specific accounts, and accounts submitted to Laboratory accounting. The structure of the files, the instructions for executing MANAGER, and the procedures for storing files, punching cards, and generating reports are described. ERA

N78-16683# Los Alamos Scientific Lab., N. Mex.
INGEN: A GENERAL PURPOSE MESH GENERATOR FOR FINITE ELEMENT CODES
W. A. Cook 1977 23 p refs Presented at the ADINA Conf., Cambridge, Mass., 4-5 Aug. 1977
(Contract W-7405-eng-36)
(LA-UR-77-1345; Conf-770813-3) Avail: NTIS HC A02/MF A01

The basic parts of the code are surface and three-dimensional region generators that are linear-blending interpolation formulas. These generators are based on an i, j, k index scheme which is used to number nodal points, construct elements, and develop displacement and traction boundary conditions. ERA

N78-16684# Rochester Univ., N. Y. Production Automation Project.
USERS GUIDE TO STGPAK, A STRING PACKAGE FOR FORTRAN PROGRAMMERS; VERSION V001C
W. Burns Fisher Oct. 1976 21 p
(Contract NSF APR-72-03419)
(PB-272431/8; CRDM-5a; NSF/RA-761132) Avail: NTIS HC A02/MF A01 CSCL 09B

STGPAK is a software package consisting of FORTRAN subprograms which allows the user to manipulate character strings within a FORTRAN program in a natural and machine-independent manner. Subroutines and functions are provided to allow the user to concatenate strings, to search for substrings, to select and copy substrings, to determine string lengths, and to perform I/O and various miscellaneous string operations. While STGPAK itself may be dependent on the characteristics of its host computer, programs using STGPAK may be written in machine-independent ANSI FORTRAN. This guide provides users with the information needed to use STGPAK. The reader is assumed to be familiar with the FORTRAN language and with general concepts of character string manipulation. GRA

N78-16685# National Cancer Inst., Bethesda, Md. Image Processing Unit.
PROCEDURAL DESCRIPTION LANGUAGE (PRDL) Final Technical Report
B. Shapiro, P. Lemkin, and L. Lipkin 10 Oct. 1977 93 p refs
(PB-273112/3; NCI/IP-77-04; TR-15) Avail: NTIS HC A05/MF A01 CSCL 09B

A high level modelling language is designed for use in performing interactive image description and analysis. The user interactively designs models incorporating problem domain knowledge on both the low level image processing and successively higher levels of processing abstraction. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N78-16686 California Univ., Los Angeles.
OPTIMAL TASK AND FILE ASSIGNMENT IN A DISTRIBUTED COMPUTING NETWORK Ph.D. Thesis
Robert Poon-Lun Lee 1977 331 p
Avail: Univ. Microfilms Order No. 77-23896

Efficient methods of assigning subprocesses to computer sites were sought such that a cost equation consisting of processing and communication costs is minimized. Both algorithmic and heuristic search techniques were employed to study the optimal assignment problem. In the special case where the process graph to be assigned is a tree, a very efficient method for optimal assignment is available. In all cases, the cost of performing assignment is more dependent on the of the process graph being assigned than the site of the process graph. The logistics for strategic reassignment were studied and the results of experiments are reported. Dissert. Abstr.

N78-16687 Missouri Univ., Rolla.
COMPUTER-AIDED NETWORK SYNTHESIS Ph.D. Thesis
James Henry Hahn 1977 109 p
Avail: Univ. Microfilms Order No. 77-23691

A technique is presented for synthesizing an electronic network using a digital computer as a basic design tool. The procedure requires that an elementary network be postulated as a starting point. The network parameters are modified by gradient techniques to meet a specified performance criterion. Then the topology of the network is modified according to rules described herein, and again subjected to the optimization process. Alternate changes in topology and element values provide continuous improvement in the network's performance. The procedure is shown to be limited by the classical local-optimum problem. Restrictions on the optimization process used are investigated, and a suitable technique selected. A computer program was written to implement the optimization and topology modification steps. Examples of networks generated by the program for various performance criteria and starting points are given. Dissert. Abstr.

N78-16688# Massachusetts Inst. of Tech., Cambridge.
DEADLOCK DETECTION IN COMPUTER NETWORKS M.S. Thesis
Barry Goldman Sep. 1977 88 p refs
(Contract N00014-75-C-0661)
(AD-A047025; MIT/LCS/TR-185) Avail: NTIS
HC A05/MF A01 CSCL 09/2

The problem of detecting process deadlocks is common to transaction oriented computer systems which allow data sharing. Several good algorithms exist for detecting process deadlocks in a single location facility. However, the deadlock detection problem becomes more complex in a geographically distributed computer network due to the fact that all the information needed to detect a deadlock is not necessarily available in a single node, and communications may lead to synchronization problems in getting an accurate view of the network state. In this thesis, two published algorithms dealing with deadlock detection in computer networks are discussed, and examples demonstrating the failure of these algorithms are given. Two algorithms are then presented for detecting deadlocks in a computer network which allows processes to wait for access to a portion of a database, or a message from another process. The first algorithm presented is based on the premise that there is one control node in the network, and this node has primary responsibility for detecting process deadlocks. The second, and recommended, algorithm distributes the responsibility for detecting deadlocks among the nodes in which the involved processes and resources reside. Thus a failure of any single node has limited effect upon the other node in the network. A computer model of the decentralized (second) algorithm was designed and it is described in the thesis. Author (GRA)

N78-16689# Los Alamos Scientific Lab., N. Mex.
QUEUING NETWORK MODELS OF COMPUTER SYSTEMS WITH LIMITED PARALLELISM IN SUBNETWORKS
T. W. Keller Jan. 1977 16 p refs Presented at the Intern. Symp. on Computer Performance Modeling, Meas., and Evaluation, Yorktown Heights, N. Y., 16-18 Aug. 1977
(Contract W-7405-eng-36)
(LA-UR-77-894; Conf-770812-2) Avail: NTIS
HC A02/MF A01

The classic central server model of computer systems is extended by allowing more realistic I/O distributions and by the introduction of passive resources. Two computationally inexpensive decomposition techniques are presented which obtain approximate solutions to the model. The first makes the exponential assumption for a composite server approximating the properties of the subnetwork. The second method uses the results of Sauer to remove the exponential restriction on the composite server. The solution methods are applied to an extended central server model of a CDC 6000 series computer system in which the passive resources are a pool of peripheral processors which limit the number of I/O processes which may be active. An investigation of the accuracy of both methods is made over a wide range of realistic model parameters. ERA

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N78-16690 California Univ., Los Angeles.
A NEUROCYBERNETIC APPROACH TO MAN-MACHINE COMMUNICATION Ph.D. Thesis
Robert Jones Hickman 1977 179 p
Avail: Univ. Microfilms Order No. 77-23870

The main theme in this research was directed toward previously unexplored neurocybernetic aspects of man-machine communication and presents findings showing the potential of on-line real-time processing of neuroelectric signals and particularly of evoked responses. The data analysis and display capabilities were systematically incorporated into the on-line functions to produce an interactive experiment control and analysis system which provides immediate results on an experiment in progress. The emphasis was centered on the input channel of the man-machine system, that is the communication channel from man to the computer. Typically the computer input function is performed by skeletal muscle activation of a data entry device, for example a keyboard, joystick, wheel, padal, etc. These channels achieve a bandwidth of a few hertz and require varying levels of training and concentration for efficient communication. This research examines techniques to approach endogenous control of data entry. Signals collected directly from the brain are processed for entry into the computer so that, in effect, neurological prosthetic efferent is created. Dissert. Abstr.

N78-16691 University of Illinois at the Medical Center, Chicago.
COMPARATIVE PERFORMANCE EVALUATION OF SOME TECHNIQUES FOR RANKING PATTERN RECOGNITION FEATURES Ph.D. Thesis
Banghui Francis Wu 1977 299 p
Avail: Univ. Microfilms Order No. 77-23760

One of the most important problems in pattern recognition is the selection of effective features from a given set of features or measurements. The performance of the recognition system is usually expressed in terms of the probability of misrecognition or error, P sub e. It is desirable to select those features which minimize P sub e. The only guaranteed technique for finding the best subset of say N features from a pool of M features is to do an exhaustive-search of all the subsets with size N, even in the case of normal densities. Since (MN) possible combinations have to be evaluated, exhaustive search is computationally impractical even for sets of moderate size. Instead heuristic techniques which attempt a suboptimal solution are used. A method called feature ranking is used to select features in most cases. This method makes an ordered list of the features such that the first N members from the top of the list will constitute a good group of N features, although not necessarily optimal, for all N. Dissert. Abstr.

N78-16692 Pittsburgh Univ., Pa.
METHODOLOGY AND EXPERIMENTATION IN CONTROL Ph.D. Thesis
Mary Louise Ehnot Soffa 1977 176 p
Avail: Univ. Microfilms Order No. 77-23549

An operational process for control separation is presented which takes the form of an information structure model. The model is composed of generic data structures which constitute program execution state and primitives for manipulating the structures to effect state change. This information structure model forms the basis for a multi-level control description technique, CDIL. The utility of the CDIL system for data gathering is demonstrated by the coupling of the Coroutine PASCAL system to a trace-driven storage management scheme. Coroutine PASCAL programs were executed by the interpreter with a trace of all control events being generated. The control-event trace was used to drive the spaghetti stack model. Empirical results are obtained from experiments investigating language design decisions, programming styles, and alternative policies in the storage management scheme. From these results, some empirical insight into the impact of these issues on the storage management scheme are discussed. Dissert. Abstr.

N78-16693 Case Western Reserve Univ., Cleveland, Ohio.
A STATISTICAL PATTERN RECOGNITION APPROACH TO AN ON-LINE ISOLATED WORD RECOGNITION SYSTEM Ph.D. Thesis
Chi-Foon Chan 1977 151 p
Avail: Univ. Microfilms Order No. 77-25148

A statistical pattern recognition approach is used to implement an isolated word recognition system. The system is adaptive and on-line and could be applied for recognition of any spoken language. The system is based on an array of the prototypes of newly defined speech units, which are used to classify an unknown isolated word. A polynomial discriminant function is used to establish the probability density function for voice/unvoice/silence parts of speech. Based on these densities, segmentation accuracy of 95% was obtained. Voice segments are further segmented into phonemic units using energy and formants changes. A Baysean Classifier is used for recognition of phoneme and phoneme pair. Word Classification is achieved by finding the word with the highest score for its phonemic transcription. The system performs quite well for a single designated speaker, but shows speaker dependency where tested against a speaker not trained to the system. Dissert. Abstr.

N78-16694 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
OBSERVABILITY AND IDENTIFIABILITY OF NONLINEAR DYNAMICAL SYSTEMS WITH AN APPLICATION TO THE OPTIMAL CONTROL MODEL FOR THE HUMAN OPERATOR Ph.D. Thesis
Raymond E. Siferd 1977 275 p
Avail: Univ. Microfilms Order No. 77-24052

The observation process is viewed as a nonlinear mapping of the initial states to the output measurements. The problem of observability and identifiability is then reduced to finding conditions under which the nonlinear mapping is one-to-one. The nonlinear theory is then applied to the problem of determining the identifiability of the optimal control model for the human operator. The - model assumes that the operator performance is dictated by the desire to behave optimally with respect to a chosen cost functional under constraints. Within the model structure are a number of parameters, the values of which determine the model response. Previous attempts to establish the identifiability of the model parameters were limited to linear system theory. The identifiability of the model parameters is established using the nonlinear theory, a gradient computational technique is used to estimate model parameters, and the results of model response to experimental simulator data are presented. Dissert. Abstr.

N78-16695 Nebraska Univ., Lincoln.
INVESTIGATIONS TOWARD THE DEVELOPMENT OF AN INTERACTIVE ON-LINE PATTERN RECOGNITION STRUCTURAL INTERPRETATION SYSTEM USING CARBON 13 PROTON NOISE DECOUPLED NUCLEAR MAGNETIC RESONANCE SPECTRAL DATA Ph.D. Thesis
Thomas Richard Brunner 1977 242 p
Avail: Univ. Microfilms Order No. 77-29485

The development of an interactive on-line pattern recognition structural interpretation system using C13 proton noise decoupled nuclear magnetic resonance spectral data was studied. Various pattern recognition approaches were explored as possible means of answering the same types of structural questions an nmr spectroscopist would ask. Pattern recognition is used to predict, using the cnmr spectral information, the presence or absence of structural subunits. Some of the structural fragments investigated include phenyl, carbonyl, carbon-carbon double bonds, methoxy, acetyl, and tertiary butyl. The system is intended to be implemented with a minicomputer directly linked to the nmr instrument. Included are studies investigating the most effective cnmr spectral data representation for classifier development. Dissert. Abstr.

N78-16696# Utah Univ., Salt Lake City. Dept. of Computer Science.
SENSORY INFORMATION PROCESSING Final Technical Report, 1 Jul. 1976 - 31 Mar. 1977
Thomas G. Stockham, Jr. Apr. 1977 115 p refs
(Contract DAHC15-73-C-0363; ARPA Order 2477)
(AD-A046950; UTEC-CSC-77-118) Avail: NTIS HC A06/MF A01 CSCL 06/4

Section I of this report discusses the theoretical underpinnings of a new mathematical model describing some of the perceptual characteristics of human sensory information processing. While much of the mathematics of the proposed model is explained here, experimental testing and verification has yet to take place. This work will continue to be pursued under alternate funding. Section II discusses in detail the background considerations necessary to understand the problems of removing atmospheric turbulence blur from images. This area of research is currently in transition from the stage of artificial computer models, to the stage of working with the simplest real data, i.e. case of a point light source, a star, viewed through the earth's atmosphere. After the termination of this contract this work will be funded by the Air Force Office of Scientific Research under grant number 77-3212. Section III reports the background and progress to date on building the tools necessary for an image understanding system. These tools as described were incorporated into a manual image understanding system designed to do analysis by synthesis. The system handles two-dimensional single objects on non-textured backgrounds, but only at the level of a trial testbed. Necessary next steps in developing a working system are outlined. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N78-16697 Carnegie-Mellon Univ., Pittsburgh, Pa.
EXISTENCE AND STABILITY OF ABSTRACT VOLTERRA INTEGRAL EQUATIONS Ph.D. Thesis
Donald A. Balenovich 1977 47 p
Avail: Univ. Microfilms Order No. 77-20613

In two abstract linear integral equations function(t) is a family of linear operators on a real Hilbert space H and f is an H-valued function. Work was done to transform the equations and supply coercivity conditions on the real and imaginary parts of the transform of the kernel which insure the existence of a solution. Using the behavior of these solutions for small and large values it was shown that the solution of the original integral equations asymptotically approachs a constant or zero. Convexity conditions which imply the transform conditions were given. Also applications of the results in control theory, visco-elasticity, and heat theory were presented. Dissert. Abstr.

N78-16698 California Univ., Los Angeles.
TOTALLY POSITIVE MATRICES, SEMI-SIMPLE ALGEBRAS, AND ERROR-CORRECTING CODES Ph.D. Thesis
Robert Lowell Miller 1977 74 p
Avail: Univ. Microfilms Order No. 77-23906

Let A be an m x n matrix over a field K, and let S be contained in [1,2,...,n]. A is called totally positive with respect to S, or more shortly a T sub S -matrix, if every minor of A

whose columns are indexed by S is non-singular. Let v be a vector in K to the nth power, and A a nonsingular m x n T sub S -matrix. Using this, several new families of error-correcting codes are constructed; they generalize the well-known BCH codes and the polynomial codes of Goethals. If G is a nonabelian group and (q,/G/) = 1, then the structure of all weight-preserving automorphisms of IF sub q [G] is determined. Using this, it is shown that the above result about the weight enumerators of minimal ideals if IF sub 2 [G] for abelian groups G does not extend to nonabelian groups. Dissert. Abstr.

N78-16699 Utah Univ., Salt Lake City.
CELL-LIKE MAPS WHICH ARE SHAPE FIBRATIONS Ph.D. Thesis
Thomas Carl McMillan 1977 89 p
Avail: Univ. Microfilms Order No. 77-23434

There exist cell-like maps which are not shape fibrations, as evidenced by the Taylor map. The purpose here is to determine exactly which maps are cell-like shape fibrations. It is shown that a cell-like map between finite dimensional metric compacta is a shape fibration if and only if it is an hereditary shape equivalence. Also it is shown that every hereditary shape equivalence between compact metric spaces is a shape fibration. Thus since every hereditary shape equivalence is a cell-like map, it follows that every hereditary shape equivalence between compact metric spaces is a cell-like shape fibration. For maps between arbitrary compact spaces, the notions of cell-like shape fibration and hereditary shape equivalence are not equivalent, as illustrated by an example due to Edwards and Hastings. An infinite dimensional Whitehead theorem is given for shape theory and it is applied to establish a condition under which a shape fibration is an hereditary shape equivalence (hence a cell-like map). Dissert. Abstr.

N78-16700 Pennsylvania Transportation Inst., University Park.
ON THE RANKS OF PARTITIONS Ph.D. Thesis
Margret F. Kothmann 1977 60 p
Avail: Univ. Microfilms Order No. 77-23249

It is important in the additive theory of numbers to find asymptotic expansions for partition functions. The first significant advance in this field was made by Hardy and Ramanujan in 1917 when they found asymptotic formulae for p(n), the number of ordinary partitions of n. Many other results of this type since then have been found by Rademacher and his students. The partition function N(m,g,n) was studied when the number of partitions of n which have rank congruent to m modulo q; the rank of a partition is equal to the largest part less the number of parts. By using methods similar to those of Rademacher, Andrews, and Dragonette, an asymptotic formula for N(m,q,n) in the cases q = 3 and q = 5 is derived, and it is shown that N(m,q,n) is approximately 1/q p(n). Dissert. Abstr.

N78-16701 Utah Univ., Salt Lake City.
COMPUTING THE DEGREE OF MAPS AND A GENERALIZED METHOD OF BISECTION Ph.D. Thesis
Ralph Baker Kearfott 1977 172 p
Avail: Univ. Microfilms Order No. 77-23103

An algorithm is presented for computation of the topological degree d(F,S, theta sub n) of F at theta sub n relative to a given n-simplex S. The mapping F:S - approaches R to the nth power is assumed to be continuous; theta sub n is the zero vector in R to the nth power. This algorithm is modified to compute approximate solutions of F(X) = theta sub n. The work depends on a preliminary lemma for n-dimensional polygons P, which gives an identity for d(F,P, theta sub n) in terms of degrees of a truncated mapping F sub 1, defined on (n-1)-dimensional polygons obtained from P. Some special characterizations of d(F,P, theta sub n) appear in the process of development of the algorithm. These formulas for d(F,P, theta sub n) involve n x n matrices with entries plus or minus 1. The algorithm can be incorporated into a method of computing zeros of F. Time and efficiency compare favorably with Sperner simplex methods. The theory is compared with methods involving Sperner simplexes. Several applications and examples are also presented. Dissert. Abstr.

N78-16702 Arkansas Univ., Fayetteville.
PROJECTIVE REPRESENTATIONS FOR ENERGY BAND CALCULATIONS Ph.D. Thesis
Richard Ray Head 1977 88 p
Avail: Univ. Microfilms Order No. 77-23345

Methods are presented for obtaining most of the irreducible representations of the space groups needed for symmetry considerations in solid state energy band calculations. For each point inside or on the surface of the Brillouin zone a 2-cocycle of the associated point group is provided geometrically and the needed irreducible representations of the group of the wave vector at this point may be obtained from projective representations associated with this cocycle. In the large majority of cases the group-theoretical structure of the point group is such that these projective representations are all monomial. FORTRAN 4 programs implementing these computational techniques have been linked with solid state routines for the calculation of energy levels utilizing J. C. Slater's Augmented Plane Wave Method. Dissert. Abstr.

N78-16703 Columbia Univ., New York.
ELIMINATION OF BOUNDS IN OPTIMIZATION PROBLEMS BY TRANSFORMING VARIABLES Ph.D. Thesis
Fern Sassower Sisser 1977 91 p
Avail: Univ. Microfilms Order No. 77-24346

The problem of minimizing a nonlinear objective function of a variable, with continuous first and second partial derivatives, subject to nonnegativity constraints or upper and lower bounds on the variables was studied. The advisability of solving such a constrained optimization problem by making a suitable transformation of its variables in order to change the problem into one of unconstrained minimization was considered. A set of conditions which guarantees that every local minimum of the new unconstrained problem also satisfies the first-order necessary (Kuhn-Tucker) conditions for a local minimum of the original constrained problem was developed. The convexity of the transformed objective function was studied and it is shown that while the transformed objective function is not necessarily convex (even if the original objective function is), there are certain conditions under which the transformed objective function will maintain the convexity of the original objective function, at least in a neighborhood of the solution. Dissert. Abstr.

N78-16704 Colorado Univ., Boulder.
SYSTEMS OF DIAGONAL EQUATIONS OVER FINITE FIELDS Ph.D. Thesis
Kenneth Wallace Spackman 1977 109 p
Avail: Univ. Microfilms Order No. 77-24296

A system of n diagonal equations over GF(q) was studied. For fixed positive integers d sub 1, d sub 2...d sub t the number of simultaneous solutions x sub 1, x sub 2...x sub t having components in GF(q) of such a system is described by the following theorem: If n is less than or equal to t and greater than or equal to 2 and if every n-subset of the set of t column vectors of A is linearly independent, then the number N of solutions for the above system of equations satisfied N equals q to the (t-n) power plus (q to the ((t-i)/2)power). The methods used including those employed in the proof of this theorem, were elementary in the sense that topological properties of complex varieties were not used and cohomology theory was avoided, rather, manipulation and estimation of character sums, including Gaussian sums, form the methodological framework. In fact it was undertaken to explore the extent to which the behavior of the number of simultaneous solutions for equations over finite fields can be described by such methods. Dissert. Abstr.

N78-16705 Oregon State Univ., Corvallis.
SINGULAR GEOMETRY AND GEOMETRIC SINGULARITIES Ph.D. Thesis
Phillip E. Parker 1977 90 p
Avail: Univ. Microfilms Order No. 77-23411

The standard techniques of differential geometry to the case of distributional (in the sense of Schwartz) pseudoriemannian structures are extended. A definition of flows for distributional vector fields is developed using generalized paths which are essentially nonlinear-distributional measures, and an existence theorem is proved when the coefficients are distribution extensions of real meromorphic functions. Conjugate points are defined by means of a characterization in the smooth case, as the caustic set of the geodesic flow. The theory is applied to obtain an interpretation of general relativity in which the Einstein equations

do not break down at spacetime singularities. Fourier Integral Operator theory is used to study the propagation of spacetime singularities and the solvability of the Einstein equations in a class of algebraically special spacetimes. Dissert. Abstr.

N78-16706 Ohio State Univ., Columbus.
CHARACTERIZATION OF LINE GRAPHS Ph.D. Thesis
Daniel Edward Nemzer 1977 178 p
Avail: Univ. Microfilms Order No. 77-24677

Some new characterizations of line graphs are proved by their geometric and spectral (eigenvalue) properties. A graph G is a finite nonempty set of vertices, together with a set of distinct edges, where an edge is an unordered pair of distinct vertices. The line graph of a graph G, is a graph L(g), whose vertices correspond to the edges of G. Two vertices of the line graph are adjacent, if they correspond to two edges of G that have one common vertex. The line graph of a tree, and the line graph of a graph with one cycle are characterized. There is a review of the literature on geometric and spectral characterizations of graphs. Geometric characterizations of two families of graphs are proved. The first is the line graph of an (r,k)semiregular bipartite graph. The second is the line graph of the bipartite graph of a balanced incomplete block design. This generalizes a result of Rao and Rao (1969). It also completes a series of geometric characterizations of line graphs. Dissert. Abstr.

N78-16707 Dartmouth Coll., Hanover, N.H.
APPLICATIONS OF THE EXTERIOR ALGEBRA TO GRAPHS AND LINEAR CODES Ph.D. Thesis
Jean Layton Gordon 1977 87 p
Avail: Univ. Microfilms Order No. 77-24832

Hypergraphs and linear codes in the context of the exterior algebra/developing the relevant algebraic theory using modern concise notation are studied With this framework and an application of Polya's theory, are counted various types of nonisomorphic hypergraphs and an explicit formula for the cycle index of the symmetric group SN acting on the k-element subsets of N is given which is needed in Polya's enumeration theorem. The exterior algebra and Grassmann coordinates are related to the following coding theoretic concepts: equivalence, minimum weight, weight distribution, self-duality and decomposability. The enumeration of codes is also related to that of hypergraphs. Dissert. Abstr.

N78-16708 Rutgers - The State Univ., New Brunswick, N. J.
FINITENESS AND DIFFERENTIAL PROPERTIES OF IDEALS Ph.D. Thesis
Sarah Glaz 1977 59 p
Avail: Univ. Microfilms Order No. 77-24981

The first chapter introduces differential algebra methods to the study of flatness over Noetherian domains. The results concern the specific cases of ideals and attempt to use the underlying divisibility properties of the rings. The two main results are: (1) a fairly complete treatment for the regular (geometric) rings, and (2) reduction in the Cohen-Macauley cases to one dimensional rings, including particular cases of the last. The second chapter is concerned with finiteness of uppers of zero. Our interest in the nature of uppers is motivated by the important role they play in the study of the integral closure of a ring. The main result of this chapter is the proof that over a coherent domain certain uppers of zero to those containing a polynomial f with c(f) to the (-1) power = A are finitely generated. Dissert. Abstr.

N78-16709 Louisiana State Univ. and A&M Coll., Baton Rouge.
TOTALLY FACTORABLE OPERATORS Ph.D. Thesis
Johnny Gills, Jr. 1977 80 p
Avail: Univ. Microfilms Order No. 77-25382

The Sp and Dp spaces are defined. Using a lemma of Figiel result about Sp - spaces are obtained. The totally factorable diagonal operators between lp-spaces are characterized. As a by-product of these characterizations it was discovered that the totally factorable operators between two arbitrary Hilbert spaces are precisely the Hilbert-Schmidt operators. The relationship between totally factorable operators and the Little Grothendieck conjecture is investigated. The composition of totally factorable operators is investigated. In general the composition of two totally factorable operators is Cohen 2-nuclear. Examples of totally factorable operators are given. Dissert. Abstr.

N78-16710 Syracuse Univ., N. Y.
HOMOMORPHISMS OF BRANCH ALGEBRAS AND BRANCH MODULES Ph.D. Thesis
Michael Joseph Evans 1976 326 p
Avail: Univ. Microfilms Order No. 77-24369

Some of the many results concerning the continuity properties of homomorphisms of Banach algebras and to a lesser extent Banach modules are discussed. Generally, the main results fall into two categories: (1) the automatic continuity of the homomorphism on all of the demain space, or (2) the automatic continuity of the homomorphism on certain subspaces of the domain space. All of the results obtained depend directly or indirectly on either the separating subspaces, the continuity ideals, or the main boundedness lemma. The relationship is considered between continuity and different purely algebraic concepts such as semi-simplicity and minimal ideals. Algebras of operators on a Banach space with a continued bisection are discussed. Dissert. Abstr.

N78-16711 Colorado Univ., Boulder.
PROXIMITY INVARIANTS AND CLOSURE INVARIANTS Ph.D. Thesis
Severino Docto Diesto 1977 288 p
Avail: Univ. Microfilms Order No. 77-24200

Some of the concepts that are preserved under p-isomorphisms were studied. In order to accomplish this, it is necessary also to consider some closure invariants since they were studied extensively. Among the invariants that are considered are separation properties, connectedness properties and compactness properties. Included under separation invariants are analogues to the following separation properties of topological space: T0, T1, T2, T3, T4, regularity, complete regularity, normality, the completely Hausdorff property, and the Urysohn property. Many of the connectness invariants that are considered have analogues in topological spaces. In fact, some theorems have parallels in topological spaces. Some theorems on topological spaces have analogues in proximity spaces which are not true. Dissert. Abstr.

N78-16712 California Univ., Los Angeles.
SOLUTIONS OF PURE EQUATIONS IN DIVISION ALGEBRAS CENTRAL OVER AN ALGEBRAIC NUMBER FIELD Ph.D. Thesis
Michael Francis Cartier 1977 67 p
Avail: Univ. Microfilms Order No. 77-23846

When K is a field it is shown that x to the m power - b is K-adequate if and only if x squared to the s power - b is K-adequate, where m = 2 to the s power k with k odd. It is determined that all x to the m power - b are adequate as long as b does not belong to the field -K squared. All polynomials of the form x squared to the s power + 4a to the fourth power are adequate for number fields not containing the square root of 2 or of -2. For polynomials not of this form the question of adequency is reduced to polynomials of the, form x to the fourth power + a squared. For polynomials in the exceptional number fields containing the square root of 2 or of -2, the criteria for adequacy are very similar to the criteria for polynomials of the form x to the fourth power + a squared. Tight criteria are given for adequacy when K is a quadratic field. Dissert. Abstr.

N78-16713 Rutgers - The State Univ., New Brunswick, N. J.
PARAMETRICES OF ELLIPTIC BOUNDARY VALUE PROBLEMS Ph.D. Thesis
Adalberto Panobianco Bergamasco 1977 60 p
Avail: Univ. Microfilms Order No. 77-24954

Parametrices of certain Elliptic Boundary Value Problems are constructed on a smooth compact manifold with boundary, under the assumption that the Lopatinski-Shapiro condition is satisfied. Roots of the principal symbol of the elliptic operator under study (considered as a polynomial in the covariable associated to the normal to the boundary) are hypothesized to be either simple or multiple with constant multiplicity. The parametrices are expressed by means of Fourier Integral Operators and the novel feature is that these have complex valued phased functions. By using these parametrices it is possible to obtain the regularity up to the boundary of the Elliptic Boundary Value Problems here considered. Dissert. Abstr.

N78-16714 Texas Univ., Austin.
FINITE ELEMENT ANALYSIS FOR THE ADAPTIVE METHOD OF REZONING Ph.D. Thesis
Francisco Manuel Guerra 1977 182 p
Avail: Univ. Microfilms Order No. 77-22963

A posteriori error estimates are derived which show that the error in the finite element solution can be bounded by a residual calculated from the finite element solution and a boundary term which characterizes the interpolation error in the boundary data. Maximum principles/St. Venant's principle indicate that the boundary error dissipates into the interior of the finite element grid. A priori error estimates for the rezoned problem show that the error in the rezone finite element solution is bounded by the conventional terms plus boundary terms that depend on the error in the rezone boundary data. Maximum principles/ St. Venant's principle indicate that the rezone boundary error decays into the interior of the rezone region, and that with successive rezones, the error in the interior regions can be further reduced. Residual error analyses are also derived for the rezoned problems. Dissert. Abstr.

N78-16715 Virginia Polytechnic Inst. and State Univ., Blacksburg.
NUMERICAL COMPUTATION OF PERTURBATION SOLUTIONS OF NONAUTONOMOUS SYSTEMS Ph.D. Thesis
Jeng-Sheng Huang 1977 56 p
Avail: Univ. Microfilms Order No. 77-24515

A numerical investigation of 2n first-order Hamilton's equations, which describe the motion of a dynamical system, was conducted using Galerkin's approximations and a derivative-free analogue of Newton's iteration method. Furthermore, the motion stability of a dynamical system in the neighborhood of the approximate periodic solutions due to the effect of the extraneous forces, introduced by the process of using the approximate solutions rather than the actual solutions, was studied by solving the nonlinear nonhomogeneous differential systems of the perturbed motion. The perturbation solutions are obtained to determine the motion stability. An example, using the van der Pol equation, illustrates the accuracy and error bounds between the approximate solutions and the actual solutions. Furthermore, the example also illustrates the motion stability of perturbation solutions. A computer program for numerical computations was developed for solving the van der Pol equation with a harmonic forcing term. Dissert. Abstr.

N78-16716 Syracuse Univ., N. Y.
THE METHODS OF REPEATED RANK REDUCTION AND MULTIPLE CORRECTION FOR THE NUMERICAL SOLUTION OF THE FREDHOLM INTEGRAL EQUATIONS OF THE SECOND KIND Ph.D. Thesis
Kanat Durgin 1976 130 p
Avail: Univ. Microfilms Order No. 77-24533

Some of the standard facts about the Fredholm integral equations of the second kind are summarized. In the second chapter, the method of repeated rank reduction to solve the Freholm integral equations of the second kind with a finite rank kernel is developed. In this method, one does not need to impose any restriction on the functions forming the kernel other than that they be nontrivial. Sufficient condition for the method of repeated rank reduction to produce a solution is determined, and then a computational algorithm is derived. Examples are presented. Adaptation of the method of repeated rank reduction to the inversion of matrices is treated in the third chapter. Four algorithms are presented to invert matrices. The first, the most efficient of the four, inverts a nonsingular square matrix of order m on its own array with m3 operations. Algorithms presented in this chapter are tested to invert finite segments of the infinite Hilbert matrix. Dissert. Abstr.

N78-16717 Syracuse Univ., N. Y.
MODELS FOR AN AXIOMATIC THEORY OF COMPUTABILITY Ph.D. Thesis
Peter Nicolaev Gabrovsky 1976 130 p
Avail: Univ. Microfilms Order No. 77-24373

A metamathematical investigation of an axiomatic theory which captures a significant portion of the theory of computability is presented. The models of this theory are called self-enumerated systems (SES). An exposition of certain basic results in the theory of SES is given. It is shown that the recursion theorem holds for every SES. It is also shown that every SES is closed under minimization, primitive recursion, and definition by cases, and in addition, that it contains each partial recursive function. Theories obtained by the addition of new axioms to those of the theory of SES are discussed. The results relating to the theories considered are employed in a discussion regarding the extent to which the theory of SES captures those of the partial recursive functions. Dissert. Abstr.

N78-16718 California Univ., Los Angeles.
EIGENFUNCTION EXPANSIONS FOR PERTURBATIONS OF ORDINARY DIFFERENTIAL OPERATORS Ph.D. Thesis
Robert Charles Carlson 1977 88 p
Avail: Univ. Microfilms Order No. 77-25328

If S is a symmetric ordinary differential operator on L squared (g), g an open interval, it is known that there are eigenfunction expansions corresponding to each self-adjoint extension of S in a possibly larger Hilbert space. Some generalizations of this result are studied when the symmetric operator is not a differential operator. For the operators studied eigenfunction expansion results closely paralleling those known for ordinary differential operators are proven. The methods are applied to certain perturbations of singular differential operators and again eigenfunction expansion. Dissert. Abstr.

N78-16719 California Inst. of Tech., Pasadena.
PART 1: EXACT SOLUTION OF SOME NONLINEAR EVOLUTION EQUATIONS. PART 2: THE SIMILARITY SOLUTION FOR THE KORTEWEG-DE VRIES EQUATION AND THE RELATED PAINLEVE TRANSCENDENT Ph.D. Thesis
Rodolfo Ruben Rosales 1977 142 p
Avail: Univ. Microfilms Order No. 77-21969

A method for finding solutions of certain diffusive-dispersive nonlinear evolution equations is introduced. The method consists of a straightforward iteration procedure, applied to the equation as it stands (in most cases), which can be carried out to all terms, followed by a summation of the resulting infinite series, sometimes directly and other times in terms of traces of inverses of operators in an appropriate space. Other equations tractable by this method are presented. These include the following equations: self-induced transparency, reduced Maxwell-Bloch, and a two-dimensional nonlinear Schroedinger. Higher order and matrix-valued equations with nonscalar dispersion functions are also presented. The second Painleve transcendent is treated in conjunction with the similarity solutions of the Korteweg-de Vries equation and the modified Korteweg-de Vries equation. Dissert. Abstr.

N78-16720 Cornell Univ., Ithaca, N. Y.
TENSOR RANK AND THE COMPLEXITY OF BILINEAR FORMS Ph.D. Thesis
Thomas David Howell 1976 130 p
Avail: Univ. Microfilms Order No. 77-18879

Previous work in this area developed methods for proving upper and lower bounds on the rank of a given tensor. An extension of these methods is used to prove that eight multiplications are necessary and sufficient to compute the product of two quaternions. A new upper bound on the complexity of Cayley number multiplication is given. A new approach to the problem consists of investigating properties of the tensor rank function instead of looking at its values one point at a time. Some of the results obtained using this functional approach concern the effect of the ring of scalars on tensor rank. For instance, it is shown that only algebraic numbers are of interest for use as scalars in evaluating sets of bilinear forms, and the ring of integers is the weakest ring of scalars for this purpose. The computability of tensor rank is discussed, and some necessary and sufficient conditions for computability of tensor rank in the integers are given. Upper and lower bounds are computed for the maximum value of tensor rank, where this maximum is taken over all tensors of a given size. Dissert. Abstr.

N78-16721# Naval Medical Research Inst., Bethesda, Md. Biometrics Div.
AN ANALOGY PERMITTING MAXIMUM LIKELIHOOD ESTIMATION BY A SIMPLE MODIFICATION OF GENERAL LEAST SQUARES ALGORITHMS

Louis D. Homer and R. Clifton Bailey Sep. 1977 12 p refs
(AD-A046957) Avail: NTIS HC A02/MF A01 CSCL 12/1

The basis for a method of modifying general nonlinear least squares algorithms for maximum likelihood estimation is developed. The resultant algorithm provides a direct general approach to maximum likelihood estimation. Only the likelihood function for a single observation need be specified. Neither second partial derivatives nor weights are required. First partial derivatives may be obtained numerically and are used to compute the covariance matrix of the estimated parameters.

Author (GRA)

N78-16722# Naval Research Lab., Washington, D. C.
ERROR BOUNDS FOR THE LIOUVILLE-GREEN APPROXIMATION TO INITIAL-VALUE PROBLEMS
James G. Taylor Jun. 1977 24 p refs
(RR0000110)
(AD-A047143; NPS-55-77-29) Avail: NTIS HC A02/MF A01 CSCL 12/1

New error bounds are developed for the Liouville-Green approximation to the solution of an important class of differential equations arising in military operations research (specifically, variable-coefficient Lanchester-type equations of modern warfare for combat between two homogeneous forces). In contrast to many previous results, our error bounds apply to initial-value problems and are expressed in terms of initial conditions. Previous error bounds for boundary-value problems are sharpened as a consequence of our development of these new error bounds for initial-value problems. Finally, applications are made to some important specific models of combat between two homogeneous forces with time-dependent attrition-rate coefficients. Author (GRA)

N78-16723# Sandia Labs., Albuquerque, N. Mex. Applied Mathematics Div.
COMPUTATIONAL SOLUTION OF NONLINEAR TWO-POINT BOUNDARY-VALUE PROBLEMS
M. R. Scott and H. A. Watts 1977 22 p refs Presented at Symp. on Computers in Chem. Eng., Vysoke Tatry, Czechoslovakia, Sep. 1977
(Contract EY-76-C-04-0789)
(SAND-76-5572; Conf-770914-1) Avail: NTIS HC A02/MF A01

A working computer code which solves quite general nonlinear two-point boundary value problems is described. The nonlinear problem is replaced by a sequence of linear problems by applying quasilinearization (Newton's method) to the nonlinear differential operator. Each linear two-point boundary value problem is solved by an initial-value procedure which combines the well-known technique of superposition with a process called orthonormalization. ERA

N78-16724# Sandia Labs., Albuquerque, N. Mex.
RIDGE REGRESSION
R. L. Iman Jan. 1977 33 p
(Contract EY-76-C-04-0789)
(SAND-76-0448) Avail: NTIS HC A03/MF A01

Ridge Regression is a description of a new multiple regression program. This program provides for a backward solution to multiple regression problems and will give the ridge regression solution for the full model. This document was designed for users of the ridge regression program. ERA

N78-16725# Los Alamos Scientific Lab., N. Mex.
PROOF OF CONVERGENCE FOR THE TRIDIAGONAL QL ALGORITHM IN FLOATING-POINT ARITHMETIC Ph.D. Thesis
J. G. Sanderson Jan. 1977 71 p refs
(Contract W-7405-eng-36; Grant NSF MCS-76-03052)
(LA-6668-T) Avail: NTIS HC A04/MF A01

Numerous routines are available to find the eigenvalues of a real symmetric tridiagonal matrix. Since it is known to converge in exact arithmetic, the tridiagonal QL algorithm with origin shift is widely used. This algorithm is analyzed here in floating-point arithmetic. This analysis suggests two modifications to the EISPACK implementation TQL1 that enable one to prove correctness and, hence, convergence of the routine. Also, it is known that the implicit and explicit versions of the QL algorithm produce the same results in exact arithmetic. A counter-example to the floating-point analog of this theorem is presented. ERA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N78-16726 George Washington Univ., Washington, D. C.
A SCALE-FREE GOODNESS-OF-FIT TEST FOR THE EXPONENTIAL DISTRIBUTION BASED ON THE SAMPLE LORENZ CURVE Ph.D. Thesis
Mitchell Henry Gail 1977 72 p
Avail: Univ. Microfilms Order No. 77-23816

A trimmed Moran statistic which is less sensitive to measurement error was evaluated. Trimming increases robustness to measurement error without substantial loss of asymptotic relative efficiency or small sample power. The trimmed Moran statistic and the Lorenz statistic are attractive goodness-of-fit tests for the exponential distribution. The Lorenz statistic enjoys the advantage of ease of computation, an exact distribution theory, robustness to measurement error, and good power in small and large samples. Dissert. Abstr.

N78-16727 Rensselaer Polytechnic Inst., Troy, N. Y.
SOME DATA ANALYSIS PROCEDURES BASED ON THE EMPIRICAL CHARACTERISTIC FUNCTION Ph.D. Thesis
John Lowrie Bryant 1977 197 p
Avail: Univ. Microfilms Order No. 77-23780

One problem considered is the assessment of the feasibility of a goodness-of-fit test based on an integral of the weighted squared modulus of the difference of the empirical and population characteristic functions. The statistic of such a test is therefore analogous to that of the Cramer-von Mises test, with the exception that now the distance between populations is measured in the transform space rather than directly in the space of distribution functions. A number of properties of the test were derived, including the asymptotic null distribution of its statistic. It is shown that under mild regularity conditions the test is consistent. Some relations to the Cramer-von Mises procedure are noted. A number of approximations to the null of the test statistic were considered, and are found to be successful in simplifying its application without undue loss of accuracy. The asymptotic power of the goodness-of-fit test against certain simple alternates is calculated under a null hypothesis of normality, and is compared to those of other tests. Preliminary results indicate that the goodness-of-fit test based on the empirical characteristic function may be of use in the analysis of multivariate data.

Dissert. Abstr.

N78-16728 Columbia Univ., New York.
SEQUENTIAL TESTS FOR FINITE POPULATIONS Ph.D. Thesis
Neng Rong Lee 1977 53 p
Avail: Univ. Microfilms Order No. 77-24102

A sequential testing procedure is proposed for finite populations. Under some assumptions, one can use weak convergence to the Brownian bridge process to analyze these kinds of sequential tests. A class of linear stopping rules for the Brownian bridge process is then investigated and a simple formula for the expected sampling time is presented. Proof is given that there exists an optimal rule in that class of stopping rules, and numerical evaluations of the performance of this rule are given. Furthermore, an asymptotic expansion of the optimal expected sampling time is obtained. Comparisons with the optimal fixed sample size test are made, and it is shown that the sequential rule performs substantially better than the fixed sample size rule.

Dissert. Abstr.

N78-16729 Wayne State Univ., Detroit, Mich.
THE EXACT AND ASYMPTOTIC POWER OF STATISTICAL TESTS VIA EXPANSIONS OF THE RADON-NIKODYM DERIVATIVE Ph.D. Thesis
Ted Radin 1977 274 p
Avail: Univ. Microfilms Order No. 77-24003

Some suitable conditions are determined under which the

power of a statistical test of hypothesis may be computed as the expectation of a certain random variable under the null hypothesis. Under additional conditions this is expandable into an infinite series, the terms of which are products of two factors. One factor involves a measure of distance (scale or location) determined by the hypothesis specified, while the other factor is an expectation of a statistic raised to a power. The latter expection is relatively simple in form and the computation is again under the null hypothesis. The asymptotic power analogue of the two-step technique described above is developed. Several asymptotic power theorems are proved which cover various contingencies such as continuous and discontinuous limiting distributions as well as critical regions which are fixed or vary with sample size. Examples of power functions derived through the above method are presented. Dissert. Abstr.

N78-16730 Carnegie-Mellon Univ., Pittsburgh, Pa.
APPROXIMATION TECHNIQUES AND OPTIMAL DECISION MAKING FOR STOCHASTIC LANCHESTER MODELS Ph.D. Thesis
Peter Paul Perla, III 1977 157 p
Avail: Univ. Microfilms Order No. 77-24906

A framework of statistical decision theory is superimposed on a simplified combat situation. Problems of both the one-stage and the multi-stage variety are studied. The one-stage decision problem requires knowledge of the probability of victory and the expected number of survivors. A complete solution to this problem is given. The multi-stage decision problem requires the distribution of the force level configuration as a function of time. A two-stage problem is solved using these approximations and backward induction. Some numerical studies are presented to provide empirical support for the accuracy and utility of the methods. The diffusion approximation methodology provides an important contribution to the study of attrition processes of the Lanchester type in the continuous time setting. Author

N78-16731 Michigan State Univ., East Lansing.
A NEW DYNAMIC STOCHASTIC APPROXIMATION PROCEDURE Ph.D. Thesis
David Ruppert 1977 35 p
Avail: Univ. Microfilms Order No. 77-25282

Robbins-Monro stochastic approximation when the regression function changes with time is considered. At time n, one can select X sub n and observe an unbiased estimator of the regression function evaluated at X sub n. Let theta sub n be the root of the regression function at time n. Our goal is to select the sequence X sub n so that X sub n - theta sub n converges to 0. It is assumed that theta sub n = f(s sub n) for s sub n known at time n and f an unknown element of a class of functions. Under certain conditions on theis class and on the sequence of regression functions, we obtain a random sequence X theta sub n such that S sub n - theta sub n converges to 0 in Cesaro mean with probability 1. Under more stringent conditions, X sub n - theta sub n converges to 0 with probability 1.
Dissert. Abstr.

N78-16732 California Univ., Los Angeles.
ROBUST TESTS ON THE EQUALITY OF DEPENDENT CORRELATION COEFFICIENTS Ph.D. Thesis
Mimi Chi-Wing Yu 1977 282 p
Avail: Univ. Microfilms Order No. 77-23938

In the study, ten test statistics for the comparison of two correlations are presented. They included seven asymptotically robust tests and three parametric tests. Of the new tests proposed, two (BOX-R, BOX-Z) were adapted from a procedure by Box for testing homogeneity of variances, two (JACKKNIFE-R, JACKKNIFE-Z) were derived from the jackknife technique, one (KENDALL) was based on Kendall's tau statistic, another one (SPEARMAN) was based on Spearman's rank correlation coefficient, and the last test (PROB-INDEX) made use of a probability-index based on the principle of concordance. The remaining three tests (R, MOD-R, Z) were based on the sample product moment correlation coefficient, or on its Fisher's z-transformation. The performance of the ten tests were compared, by Monte Carlo methods. Results from the Monte Carlo study suggested the use of the Z test when the distribution is judged to be close to a normal distribution. For the far from normal distributions, the recommended test is KENDALL. Dissert. Abstr.

N78-16733 Rensselaer Polytechnic Inst., Troy, N. Y.
ROBUST DATA ANALYSIS USING ALTERNATE ERROR MODELS Ph.D. Thesis
Kent Montgomery Brothers 1977 166 p
Avail: Univ. Microfilms Order No. 77-23778

Alternatives to the normal error model are proposed, including mixtures of a normal and a Cauchy distribution, Pearson distributions, and stable distributions. It is shown that the method of maximum likelihood, assuming such error models, provides a unified, computationally viable approach to robust estimation. Considerations for the selection of both univariate and multivariate error models are given. Computational procedures are developed for accurate evaluation of functions related to the stable distributions. Simple iterative procedures for the computation of maximum likelihood estimates are developed in the univariate and multivariate estimation frameworks and in the multiple regression framework. Robustness properties of the estimators are examined, and Monte Carlo methods appropriate to the error distributions considered are developed. Applications of the approach to other models are discussed. Dissert. Abstr.

N78-16734 Virginia Polytechnic Inst. and State Univ., Blacksburg.
LINEAR AND NONLINEAR STOCHASTIC DIFFERENTIAL EQUATIONS WITH APPLICATIONS Ph.D. Thesis
Wojciech Boguslaw Stasiak 1977 115 p
Avail: Univ. Microfilms Order No. 77-20263

First and second order moment equations are derived for a general class of stochastic nonlinear equations by performing a renormalization at the level of the second moment. A complete set of closed equations for the first two moments within the framework of an approximation corresponding to the direct-interaction approximation results. Closed form solutions are found for the equations governing the random fluctuations of a velocity field under the assumption of special time dependent, uniform or sheared, mean flow profiles. The problem of a randomly perturbed quantum mechanical harmonic oscillator is investigated. The equations for the ensemble average of the Wigner distribution function are defined. Dissert. Abstr.

N78-16735*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHAIN POOLING MODELING SELECTION AS DEVELOPED FOR THE STATISTICAL ANALYSIS OF A ROTOR BURST PROTECTION EXPERIMENT
Arthur G. Holms Dec. 1977 60 p refs Presented at 137th Ann. Meeting, of the Am. Statist. Assoc., Chicago, 15-18 Aug. 1977
(NASA-TM-73874; E-9479) Avail: NTIS HC A04/MF A01 CSCL 12A

As many as three iterated statistical model deletion procedures were considered for an experiment. Population model coefficients were chosen to simulate a saturated 2 to the 4th power experiment having an unfavorable distribution of parameter values. Using random number studies, three model selection strategies were developed, namely, (1) a strategy to be used in anticipation of large coefficients of variation, approximately 65 percent, (2) a strategy to be sued in anticipation of small coefficients of variation, 4 percent or less, and (3) a security regret strategy to be used in the absence of such prior knowledge. Author

N78-16736# Naval Postgraduate School, Monterey, Calif.
OPTIMAL BAYESIAN ESTIMATION OF THE STATE OF A PROBABILISTICALLY MAPPED MEMORY-CONDITIONAL MARKOV PROCESS WITH APPLICATION TO MANUAL MORSE DECODING Ph.D. Thesis
Edison Lee Bell Sep. 1977 196 p refs
(AD-A046503) Avail: NTIS HC A09/MF A01 CSCL 09/4

This dissertation investigates the problem of automatic transcription of the hand-keyed Morse signal. A unified model for this signal process transmitted over a noisy channel is shown to be a system in which the state of the Morse process evolves as a memory-conditioned probabilistic mapping of a conditional Markov process, with the state of this process playing the role of a parameter vector of the channel model. The decoding problem is then posed as finding an optimal estimate of the state of the Morse process, given a sequence of measurements of the detected signal. The Bayesian solution to this nonlinear estimation problem is obtained explicitly for the parameter-conditional linear-Gaussian

channel, and the resulting optimal decoder is shown to consist of a denumerable but exponentially expanding set of linear Kalman filters operating on a dynamically evolving trellis. Decoder performance is obtained by computer simulation, for the case of random letter message texts. GRA

N78-16737# Cornell Univ., Ithaca, N. Y. School of Operations Research and Industrial Engineering.
DESIGN OF EXPERIMENTS FOR SELECTION FROM ORDERED FAMILIES OF DISTRIBUTIONS
Jeffrey H. Hooper and Thomas J. Santner Aug. 1977 54 p refs
(Contracts DAAG29-73-C-0008; DAAG29-77-C-0003; N00014-75-C-0586; Grant NSF ENG-75-10487)
(AD-A047056; TR-350) Avail: NTIS HC A04/MF A01 CSCL 12/1

This paper studies the problem of designing a single stage experiment for the selection of the distribution(s) with the largest alpha-quantile(s) where alpha epsilon(0,1) is given and when the model assumptions are specified by an ordered family of distributions. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N78-16738 Case Western Reserve Univ., Cleveland, Ohio.
STABILITY CRITERIA FOR NONLINEAR AND STOCHASTIC DYNAMICAL SYSTEMS Ph.D. Thesis
Kenneth Alan Loparo 1977 110 p
Avail: Univ. Microfilms Order No. 77-25175

The asymptotic stability properties of systems of smooth nonlinear differential equations and linear feedback systems with stochastic feedback gains are analyzed. An algorithm for estimating the domain of attraction of smooth nonlinear systems is developed using the representation of approximate solutions by Carelman linearization. The stability algorithm is applied to the transient stability analysis of a two-machine power system and improvements in previous estimates of the domain of attraction are observed. A partial result establishes the equivalence of the sample path stability behavior of linear feedback systems with stochastic feedback gains which are Random Telegraph processes and the 'associated' white noise systems. Digital simulation results for a two dimensional example, the damped harmonic oscillator, demonstrate the result. Dissert. Abstr.

N78-16739 Wayne State Univ., Detroit, Mich.
AN APPROXIMATE ANALYSIS OF PARAMETRICALLY-EXCITED LINEAR SYSTEMS Ph.D. Thesis
Subhash Chandra Sinha 1977 110 p
Avail: Univ. Microfilms Order No. 77-24016

The investigation deals with the approximate analysis of parametrically-excited, second-order, linear systems, through the application of orthogonal polynomials. The time dependent functions appearing as coefficients in the system equations may be periodic, non-periodic or can have multiple zeros. These variable coefficients are replaced by simple functions using orthogonal polynomial expansions, such that the approximate differential equations thus obtained have known closed form solutions. If the time-dependent coefficient is approximated by a constant, the approximate solutions are the sine and cosine functions, while a linear approximation leads to solutions in terms of Bessel functions. The quadratic approximation of the function results in Weber's equation and the solutions are the parabolic cylindrical functions. The method has been applied to study the transient response of systems governed by Mathieu equations and equations with turning points. The results are compared with the numerical solutions and the well-known WKBJ results. Dissert Abstr.

N78-16740 Pennsylvania State Univ., University Park.
HETEROGENEOUS MULTI-SERVER QUEUING SYSTEMS WITH SWITCHING RULES Ph.D. Thesis
Yunkee Ahn 1977 113 p
Avail: Univ. Microfilms Order No. 77-23204

A variety of queuing systems, depending on the complexity of the assumptions relating to a particular system, use special methods and obtains special results. The systems involved can be classified in four ways: (1) the classical formulations relating to types of input and service, (2) the number of servers, (3) whether the queuing discipline is single-line or multi-line, and (4) according to a number of switching rules, i.e., queuing disciplines such as balking, reneging and jockeying. The methods used in obtaining steady state probabilities for the single-line systems are the balance equations method and the supplementary variable method. Finally, the comparisons among the systems were discussed by comparing each system with the homogeneous system and obtaining some optimal values. Dissert. Abstr.

N78-16741 Texas Univ., Austin.
A TANDEM-QUEUE ALGORITHM FOR EVALUATING OVERALL AIRPORT CAPACITY Ph.D. Thesis
Chang-Ho Park 1977 190 p
Avail: Univ. Microfilms Order No. 77-23011

Development is given for an analytical model of an airport system that can be used to evaluate overall airport capacity. Capacity is defined as the maximum flow-rate that can be imposed on an airport without violating user-specified, level-of-service criteria for airport components. A deterministic queueing algorithm is presented. The main thrust of the approach is to tie individual component models together to relate the input to one component and the output to one component and the output from preceding components. The overall algorithm is intended for estimating component level of service measures. These measures are then evaluated by the user of the model. Dissert. Abstr.

N78-16742 Pittsburgh Univ., Pa.
IDENTIFICATION AND ADAPTIVE ESTIMATION IN LINEAR DISCRETE STOCHASTIC DYNAMIC SYSTEMS Ph.D. Thesis
George Lyman Wright 1977 186 p
Avail: Univ. Microfilms Order No. 77-23563

An algorithm for performing identification and adaptive estimation in linear discrete stochastic dynamic systems is described. The major emphasis of the algorithm was to obtain accurate, near maximum likelihood estimates of the original signal process with a minimum of computational effort, as opposed to reconstructing the entire model parameter space. The algorithm is structured around the stochastic difference equation representation of a given process, as opposed to the state space realization. The algorithm solves the Wold type problem of finding the white noise input to a causal and causally invertible stationary filter that will generate the desired second order stationary process. Simulation results are offered for both the single-input, single-output and multi-input, multi-output cases. In addition, the results of the algorithm presented are compared with other currently available techniques. An application of the results of this dissertation to the problem of estimating arrival times in a demand actuated transportation system was investigated. Dissert. Abstr.

N78-16743# Michigan Univ., Ann Arbor. Dept. of Industrial and Operations Engineering.
RESEARCH INTO QUEUING NETWORK THEORY Final Report
Ralph L. Disney Sep. 1977 28 p refs
(Contract N00014-75-C-0492; N00014-67-A-0181-0004.23)
(AD-A047148) Avail: NTIS HC A03/MF A01 CSCL 12/1

Research under this contract has been comprised of several subareas. The following is a terse listing of the areas. They will be discussed in greater detail in the following report in the indicated sections: Queues with Feedback; Simplification, Approximation and Flow in Jackson networks; Queues with Deterministic Service Times; and Applications of Known Results. GRA

N78-16744# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Mathematics and Statistics.
ADAPTATION OF THE SERVICE CAPACITY IN A QUEUING SYSTEM WHICH IS SUBJECTED TO A CHANGE IN THE ARRIVAL RATE AT UNKNOWN EPOCH
M. Yadin and S. Zacks 1 Nov. 1977 27 p refs
(Contract N00014-75-C-0529)
(AD-A046973; TR-30) Avail: NTIS HC A03/MF A01 CSCL 12/1

The paper studies the problem of optimal adaptation of an M/M/1 queuing station, when arrival rate lambda sub zero of customers shifts at unknown epoch, tau to a known value, lambda sub 1. The service intensity of the system starts at mu 0 and can be increased at most n times to mu 1 - mu2 - ...- mu N. The cost structure consists of the cost of changing mu(i) to mu(j) (i-1 < or = j < or = N); of maintaining service at rate mu (per unit of time) and of holding customers at the station (per unit of time). Adaptation policies are constrained by the fact that mu can be only increased. A Bayes solution is derived, under the prior assumption that tau has an exponential distribution. This solution minimizes the total expected discounted cost for the entire future. Author (GRA)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N78-16745 Adelphi Univ., Garden City, N. Y.
THE DENSITY THEOREMS OF ADDITIVE NUMBER THEORY AND ABELIAN GROUPS: AN HISTORICAL EXPOSITION Ph.D. Thesis
Michael Steuer 1977 216 p
Avail: Univ. Microfilms Order No. 77-22573

The concept of density in additive number theory is used to classify sequences of non-negative integers. For example, while the set of positive integers and the set of positive odd integers are each countably infinite and hence contain the same cardinality, intuition says that the first set is more dense than the other. Various definitions are used to describe the density of a sequence of non-negative integers; these definitions were motivated by the need to classify a sequence in order to derive basic properties. The main type of density which is explored is what is called arithmetic density (commonly referred to as Schnirelmann density), an important type of density used in additive number theory. Dissert. Abstr.

N78-16746 Nebraska Univ., Lincoln.
MEANS WITH VALUES IN A BANACH LATTICE AND SOME RESULTS OF TENSOR PRODUCTS Ph.D. Thesis
Ramabhadrasarma Ivatury 1977 68 p
Avail: Univ. Microfilms Order No. 77-23143

Means with values in a Banach lattice and amenability were studied. Some well known concepts in amenability theory, such as invariance, introversion and right stationary semigroups were generalized and possible extensions of several known characterizations of amenability are discussed. The notion of a right stationary semigroup was extended by replacing the convex hull of right translates of a function by the smallest convex sublattice containing these right translates. Weak tensor products of almost periodic functions, of weakly almost periodic functions and of uniformly continuous functions on two Hausdorff topological groups are discussed. Dissert. Abstr.

N78-16747 Missouri Univ., Rolla.
STRICT CONVEXITY IN LOCALLY CONVEX SPACES AND FIXED POINT THEOREMS IN GENERALIZED HILBERT SPACES Ph.D. Thesis
Ed Wilburn Huffman 1977 50 p
Avail: Univ. Microfilms Order No. 77-23683

A new definition of strict convexity is introduced for locally convex spaces. Examples are given and several characterizations of strict convexity are established for locally convex spaces whose generating family of seminorms satisfies the parallelogram law. Some fundamental fixed point theorems are proved for locally convex spaces whose generating family of seminorms satisfies the parallelogram law. Other fixed point theorems are proved for strictly convex locally convex spaces which are also F-spaces. Dissert. Abstr.

N78-16748 Columbia Univ., New York.
CLASSIFICATION OF THE TOROIDAL GROUPS Ph.D. Thesis
Viera Krnanova Proulx 1977 151 p
Avail: Univ. Microfilms Order No. 77-24118

Methods are described which considerably decrease the number of cases necessary to consider in order to obtain the best embedding for a given Cayley graph, or to find the best embedding among all the Cayley color graphs for a given group. These methods involve what Gross called 'global' and 'local obstructions'. Given one embedding, the cost (in terms of change in the genus) of a replacement of a set of faces in this embedding by another 'compatible' set of faces is computed. It is shown that an embedding is best by demonstrating that no favorable (genus decreasing) replacement set exists. Furthermore, given one (good) embedding of one Cayley color graph for a given group, an upper bound is found on the number of the generators (and some information about their orders) is a presentation of this group whose Cayley color graph could have lower genus. For any new presentation, the average face size required in an embedding of genus at most equal to the previously known one can be determined. Dissert. Abstr.

N78-16749 Montana Univ., Missoula.
EXISTENCE THEOREMS FOR NONLINEAR HAMMERSTEIN EQUATIONS Ph.D. Thesis
Champak Dayaram Panchal 1977 63 p
Avail: Univ. Microfilms Order No. 77-23631

Nonlinear integral equations of Hammerstein type have been an object of intense study since the appearance of the celebrated paper by A. Hammerstein. There are severe restrictions on the operator T in the equation u plus Tu equals w, where T maps a Banach space X into itself. In this paper existence of solutions to the equation u plus Tu equals w is proved for any w in X with simpler restrictions on T, which are much easier to check in practice. Dissert. Abstr.

N78-16750 California Univ., Los Angeles.
EXPRESSING GROUP ELEMENTS AS PRODUCTS OF COMMUTATORS Ph.D. Thesis
Robert Michael Guralnick 1977 79 p
Avail: Univ. Microfilms Order No. 77-23866

A C to the (r) power -group is one which is the rth derived group K to the (r) power of some group K. In the first part of the dissertation necessary conditions are determined for a group to be a C to the (r) power -group. As a consequence, it is shown that a necessary and sufficient condition for a finite group G to be a C to the (r) power -group for all r is that G/Z(G) is perfect. A formula is derived for the number of ways an element in a finite group G can be written as a product of m commutators. Families of groups are constructed whose commutator subgroups contain elements which are not the product of m commutators, where m is a preassigned integer. Examples of such groups with cyclic commutator subgroups are given. Some general theorems are proved showing that for certain groups, the commutator subgroup consists only of commutators. Dissert. Abstr.

N78-16751 Utah Univ., Salt Lake City.
ON INTEGRATION AND THE RADON-NIKODYM THEOREM IN QUASICOMPLETE LOCALLY CONVEX TOPOLOGICAL VECTOR SPACES Ph.D. Thesis
David Sexton Gilliam 1977 59 p
Avail: Univ. Microfilms Order No. 77-23433

A concern with the extension of the strongly measurable Pettis integral to more general locally convex topological vector spaces and an examination of the Radon-Nikodym theorem and related topics in this more general setting are presented. The various conditions show on the average ranges of a vector measure which are equivalent to the existence of a strongly measurable Pettis integrable density in Banach spaces fail to be equivalent in general. In spite of this, the local compactness Radon-Nikodym theorem of Rieffel does extend for our integral. Many Banach space results do extend to the class of locally convex spaces with the strict Mackey convergence property with only slight, but necessary modifications. Finally, the above results are applied to dual Banach spaces with the weak-* topology to obtain several results on Pettis integrable functions in Banach spaces. Dissert. Abstr.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N78-16752# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON EASTERN EUROPE SCIENTIFIC AFFAIRS, NO. 569
12 Jan. 1978 44 p Transl. into ENGLISH from Selected Foreign Periodicals (Bulgaria)
(JPRS-70472) Avail: NTIS HC A03/MF A01

Earthquakes in Kukes and Gjirokaster were studied. Characteristics of the ES-5003 computer memory tape, computer storage devices, and semiconductor designation systems were evaluated. Radiation effects on the human body and controlled nuclear fusion were also considered. The facilities of the Karisburg diabetes center are described. J.A.M.

N78-16753# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON EASTERN EUROPE SCIENTIFIC AFFAIRS
18 Jan 1978 45 p Transl. into ENGLISH from Hungarian and Rumanian articles
(JPRS-70498) Avail: NTIS HC A03/MF A01

The aeronautical and geodynamic investigations to be conducted at the Penc Cosmic Geodetic Observatory in Hungary are summarized. Methods for selection of the instruments, data processing equipment, and personnel are described. Scientific and technical programs in Rumania, Poland, and East Germany are described, as well as cooperation in computer networking among these countries and with the Soviet Union. A.R.H.

N78-16754# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: PHYSICAL SCIENCES AND TECHNOLOGY, NO. 27
17 Jan. 1978 79 p refs Transl. into ENGLISH from Russian articles
(JPRS-70493) Avail: NTIS HC A05/MF A01

Advances in Soviet technology discussed include: computer networks and networking; monitoring holographic storage devices; weather service satellites; geodesy; and interpreting ocean data obtained from space. A.R.H.

N78-16755# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON EASTERN EUROPE: SCIENTIFIC AFFAIRS, NO. 568
9 Jan. 1978 29 p refs Transl. into ENGLISH from east European Journals
(JPRS-70435) Avail: NTIS HC A03/MF A01

A Hungarian-made electrophotometer carried onboard the Vertikal-6 flight for measuring very weak space radiation is described, as well as a device for measuring electrons, ions, and ion temperature. Other topics covered include veterinary services and the use of the X-ray in examining miners in Albania; and the use of titanium fertilizer for increased grop growth in Hungary. A.R.H.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N78-16756 Pennsylvania State Univ., University Park.
AN EXPERIMENTAL TREATMENT OF AUDITORY DISCRIMINATION OF COMPLEX NOISE-LIKE SOUNDS Ph.D. Thesis
Claus Peter Janota 1977 161 p
Avail: Univ. Microfilms Order No. 77-23242

An attempt was made to quantify subjective responses to sounds, especially in the discrimination between similar sounding noise like stimuli. A model of the discrimination process as one of feature extraction and decision making about the presence of salient features was proposed. The model and the signal patterns used in the experiments were restricted to features of the sounds which are dichotomous, i.e., present in one sound pattern and absent in the other of a pair of sounds to discriminate. Experiments using both marine sounds and laboratory generated signals were conducted using trained university student listeners and Navy personnel. Two experimental methods were applied with one using a modification of classical threshold techniques. The other procedure used a continuous rating scale to elicit information about the confidence of the listener's discrimination decision. Dissert. Abstr.

N78-16757 Syracuse Univ., N. Y.
DIGITAL ANALYSIS OF MACHINE NOISE AND VIBRATION FOR SOUND POWER ACCOUNTING AND NOISE SOURCE IDENTIFICATION Ph.D. Thesis
Robert Donald Erianne 1976 238 p
Avail: Univ. Microfilms Order No. 77-24367

A digital correlation technique was implemented to calculate the sound power contributions from individual components of a large complex machine operating in a highly reverberant workspace. A system for sampling and digitally processing two stationary random signals occurring simultaneously was developed and used in the analysis of sound and vibration data obtained from the machine. Signal correlation was performed by a minicomputer programmed to Fourier transform two data sequences simultaneously, and to calculate statistically consistent auto- and cross-spectra together with standard time and frequency domain correlation functions. Dissert. Abstr.

N78-16758 Rensselaer Polytechnic Inst., Troy, N. Y.
REAL AND PHANTOM IMAGE LOCALIZATION IN MULTI-CHANNEL SOUND REPRODUCTION Ph.D. Thesis
Richard Corona Cabot 1977 627 p
Avail: Univ. Microfilms Order No. 77-23781

A system for efficiently running sound localization experiments uses stimulus parameters programmed onto plastic cards which automatically adjust the apparatus to present that stimulus. This method allows easy randomization of stimuli and minimizes the time required to present consecutive sounds. An additional feature of the system is a device which tracks head rotation with no subject discomfort or inconvenience. The apparatus is used to study human sound localization with special attention to localization in multichannel sound reproduction systems. Future experiments which are possible with the above apparatus are suggested. Modifications to the apparatus to extend its capabilities and speed are described. The real source localization performance of 11 listeners is studied. Dissert. Abstr.

N78-16759 Syracuse Univ., N. Y.
INVESTIGATIONS OF THE RADIATED NOISE FROM COAXIAL SUPERSONIC JETS TO STUDY. 1: THE EFFECT OF HEATING ONE OF THE JETS. 2: THE ROLE OF LIP THICKNESS ON NOISE SUPPRESSION Ph.D. Thesis
Pupinder Kumar Bhutiani 1976 401 p
Avail: Univ. Microfilms Order No. 77-24357

The work describes and discusses the results of the experiments conducted to extend the work on radiated noise from coaxial supersonic jets by Dosanjh and his colleagues. The extension of the work is primarily directed towards understanding the role of heating any one of the two jets in a coaxial jet system on the radiated noise and flow modifications. To achieve this, the coaxial jets were operated with either both jets cold or one of them heated up to 600 F and at various reservoir pressures. All the results presented in Part I of this dissertation are for coaxial jets issuing from a nozzle configuration having both nozzles convergent. The role of the lip thickness on the flow and radiated noise from small model cold coaxial jets having other geometrical parameters fixed are discussed. The role of the lip in modifying the individual flows is discussed and illustrated using shadowgraphs. Further studies related to problems addressed to in both the first and second part of this dissertation are outlined. Dissert. Abstr.

N78-16760 Syracuse Univ., N. Y.
NOISE STUDIES OF COLD AND HEATED MODEL JETS AT SUPERSONIC AND HIGH SUBSONIC SPEEDS WITH

PARTICULAR REFERENCE TO NOISE REDUCTION Ph.D. Thesis
Krishan Kumar Ahuja 1976 482 p
Avail: Univ. Microfilms Order No. 77-24521

The experiments primarily concentrate on extending the work on acoustic radiation from smaller and cold model coaxial supersonic jets by Dosanjh and his colleagues to heated and cold but larger model jets. Nozzles of exit area about 7 times larger than those used by Dosanjh et al., were used. Far field acoustic results measured at a polar distance of 10 ft are presented. A two nozzle arrangement was used where either both jets were kept cold or one of the jets was heated to a maximum reservoir temperature of 1000 F and operated at various pressure ratios. Particular attention is paid to the results for the coaxial jets with both nozzles convergent. Some results are presented for a configuration in which the inner nozzle was a M = 1.449 convergent-divergent nozzle and the outer nozzle was convergent. Special attention is given to a study of the effects of acoustic shielding of the radiated jet noise due to the presence of a relatively quieter heated annular layer of fluid surrounding a cold noisy single round jet. Dissert. Abstr.

N78-16761 Ohio State Univ., Columbus.
A FAR FIELD ANALYSIS OF THE PROPAGATION OF SOUND WAVES FROM VARIOUS POINT SOURCES THROUGH A LINEAR SHEAR LAYER Ph.D. Thesis
James Nicholas Scott 1977 118 p
Avail: Univ. Microfilms Order No. 77-24700

Exact analytical expressions for the far field acoustic pressure resulting from the propagation of sound waves from various types of point sources through a shear layer with a linear velocity profile were obtained. The appropriate form of the wave equation was considered in each of three adjacent regions, specifically a stationary medium, a shear layer with a linear velocity profile, and a region of uniform flow. The exact and approximate solutions were compared and good agreement was found in the respective cases of low and high frequency. Various expressions for the far field pressure were plotted to determine the effect of varying frequency, shear layer thickness, flow Mach number, etc., for the different types of sources. Dissert. Abstr.

N78-16762 Pennsylvania State Univ., University Park.
ACOUSTIC DIFFRACTION BY AN IMPEDANCE COVERED HALF-PLANE Ph.D. Thesis
Robert Paul Kendig 1977 157 p
Avail: Univ. Microfilms Order No. 77-23246

Exact, closed form solutions for diffraction and backscattering by a half-plane whose surfaces exhibit arbitrary impedances were determined for the cases of a point source, a line source, and a plane wave. An integral method was devised that could account for the impedance boundary conditions. Since the solution is in a closed form, interpretation of the influence of the impedance covered half-plane on the diffraction field is greatly facilitated. Specifically, the effect of each surface on the acoustic field dominates in the half-space in which it faces. Though the effect of each surface extends into the opposite half-space behind the barrier, this influence is very small and diminishes even more as the observer moves further behind the barrier. Dissert. Abstr.

N78-16763 California Univ., Los Angeles.
NOISE GENERATION IN HIGH SPEED MECHANICAL SYSTEMS Ph.D. Thesis
Noel Duke Perreira 1977 442 p
Avail: Univ. Microfilms Order No. 77-23913

Basic analytical models of the noise generation processes that are brought about in the operation of high speed mechanical systems were developed. As an illustration of the utilization of the acoustic models a typical machine element known as an impact beam is examined. The approximate acoustic models are used to determined the relative magnitudes of the acoustic pressure generated by the system motion. The system is dynamically modelled and the acoustic effect of varying system physical parameters is obtained using computer simulations. A second mechanical system , the impact pendulum, is also analytically and computationally examined. Design guidelines, based on the computer simulations of the four bar mechanism and the impact beam, are obtained. Dissert. Abstr.

N78-16764 Stanford Univ., Calif.
ACOUSTIC DETECTION OF THERMAL RADIATION Ph.D. Thesis
Nicolas Josef Moll 1977 108 p
Avail: Univ. Microfilms Order No. 77-25703

A new type of uncooled thermal imaging device is described. The device consists of an array of semiconductor bolometers scanned by a piezoelectric acoustic delay line. The scanning is done by charging the surface of each bolometer by means of a strong RF pulse on the delay line, and observing the rate of decay of the surface charge; this rate is strongly temperature dependent. The detailed theory of operation of the device is developed, including the processes of surface charging and discharging, acoustic attenuation as a function of the semiconductor's surface charge, thermal design problems, and noise processes. The fundamental principle of operation and the practicability of meeting some thermal design requirements are verified experimentally using silicon bolometers on a lithium niobate delay line. Dissert. Abstr.

N78-16765 Pittsburgh Univ., Pa.
INTENSITY DISCRIMINATION WITH THREE SIGNAL ENSEMBLES Ph.D. Thesis
Mark Steven Stiegel 1977 106 p
Avail: Univ. Microfilms Order No. 77-28018

Beat detection was investigated in relation to the conventional increment detection of sinusoids to determine a relationship, if any, between the two tasks. To this end, three experiments were conducted at 1000 Hz, detecting an increment in the level of a sinusoid, and detecting envelope beats generated either by the addition of two sinusoids differing in frequency by delta or by sinusoidal-amplitude modulation of a given carrier. The number of beats per 500-msec observation interval was controlled by varying the delta for two-tone beats and the modulating frequency, f sub m, for amplitude modulation. Performance was evaluated for three beat rates, 4, 8, and 16 Hz at four carrier levels, 15, 30, 45, and 60 db SPL for both methods of beat generation. Increment detection was evaluated at these same carrier levels. Three normally-hearing subjects (ANSI, 1969) listened in a 2IFC constant psychophysical procedure. Three-point psychometric functions (400 trials per point minimum) for each condition were determined to estimate threshold (76% correct). Dissert. Abstr.

N78-16766*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROPAGATION OF SOUND WAVES THROUGH A LINEAR SHEAR LAYER: A CLOSED FORM SOLUTION
James N. Scott 1978 16 p refs Presented at 16th Aerospace Sci. Meeting Huntsville, Ala., 16-18 Jan. 1978; sponsored by AIAA
(NASA-TM-73828; E-9203) Avail: NTIS HC A02/MF A01 CSCL 20A

Closed form solutions are presented for sound propagation from a line source in or near a shear layer. The analysis was exact for all frequencies and was developed assuming a linear velocity profile in the shear layer. This assumption allowed the solution to be expressed in terms of parabolic cyclinder functions. The solution is presented for a line monopole source first embedded in the uniform flow and then in the shear layer. Solutions are also discussed for certain types of dipole and quadrupole sources. Asymptotic expansions of the exact solutions for small and large values of Strouhal number gave expressions which correspond to solutions previously obtained for these limiting cases. Author

N78-16767# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ULTRASONIC VELOCITY MEASUREMENTS IN EXPANDED LIQUID MERCURY
K. Suzuki, M. Inutake, and S. Fujiwaka Oct. 1977 22 p refs (IPPJ-310) Avail: NTIS HC A02/MF A01

Measurements were made at temperatures up to 1600 C and pressures up to 1700 kg/sq cm by means of an ultrasonic pulse transmission/echo technique which was newly developed for such high temperature/pressure conditions. When the density was larger than 9 g/cu cm, the observed sound velocity decreased linearly with decreasing density. At densities smaller than 9 g/cu cm, the linear dependence on the density was no longer

observed. The observed sound velocity approached a minimum near the liquid-gas critical point. The existing theories for sound velocity in liquid metals failed to explain the observed results.
Author

N78-16768# Defence Research Establishment Pacific, Victoria (British Columbia). Research and Development Branch.
THE REFLECTION OF ACOUSTIC WAVES IN SEA WATER FROM AN ICE COVERED SURFACE
R. Verrall and J. Ganton Jun. 1977 31 p refs
(AD-A047298; DREP-TM-77-8) Avail: NTIS HC A03/MF A01 CSCL 20/1

Measurements of the acoustic reflectivity of the lower surface of sea ice were made at several locations in the channels of the Canadian Arctic Archipelago from 1971 to 1973. The distance between the projector and hydrophone was typically 100 to 300 m; the grazing angle at the ice-water interface ranged up to 30 deg, and the frequency limits were 200 Hz and 20,000 Hz. The measured reflectivities show large excursions from unity. Reflectivities of -15 db are not uncommon in spite of the uniform flatness of the ice-water interface and in spite of the shallowness of the grazing angle. However, a calculation based on Kirchhoff's Integral Theorem and involving an integration over the interface indicates that the observed undulation in the ice-water interface is sufficient to account for the observed results. GRA

N78-16769# Stanford Univ., Calif. Edward L. Ginzton Lab.
ACOUSTICALLY SCANNED OPTICAL IMAGING DEVICES Semiannual Report, 1 Jan. - 30 Jun. 1977
Gordon S. Kino Jul. 1977 36 p refs
(Contract N00014-76-C-0129)
(AD-A047050; GL-27; SAR-4) Avail: NTIS HC A03/MF A01 CSCL 09/5

A monolithic zinc-oxide-on-silicon p-n storage correlator has been constructed. When operated both as a convolver and as a storage correlator, the electronic efficiency obtained with this device is comparable to that of the present LiNbO3 airgap device. This device has the potential of having very large dynamic range because of the absence of spurious bulk wave generation, as occurs in the airgap device. Several signal processing functions have been demonstrated with this new type of storage correlator. In one chirp correlation experiment, correlation of signals with a time-bandwidth product of 4000 has been observed.
Author (GRA)

N78-16770# California Univ., Davis. Dept. of Applied Science.
TRAPPED PARTICLES AND HARMONIC GENERATION
W. E. Hobbs, Jr. (NRL, Washington, D. C.) and J. S. Degroot [1977] 19 p refs
(Contract W-7405-eng-48)
(UCRL-13727) Avail: NTIS HC A02/MF A01

A fluid-particle algorithm was used to study the evolution of continuously generated ion acoustic waves numerically. The code permits the simultaneous analysis of the two nonlinearities involved: wave steeping or harmonic genration, a fluid effect; and wave damping and amplitude oscillations, a particle effect. For a temperature ratio 10 < t/sub e//T/sub i/< 30, the behavior of low amplitude long wavelength waves is described by a Korteweg-deVries equation augmented to include a time dependent damping term. ERA

N78-16771# Sandia Labs., Albuquerque, N. Mex.
ULTRASONIC DATA ACQUISITION, ANALYSIS, AND DISPLAY BY MINICOMPUTER AIDED TECHNIQUES
J. H. Gieske 1977 16 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0526C; Conf-770903-3) Avail: NTIS HC A02/MF A01

A minicomputer-based ultrasonic data acquisition and display system is described. The system consists of a PDP-11 minicomputer with peripheral modules necessary to program the computer, control a test, acquire data, store data, analyze and display data. An ultrasonic data acquisition interface module, and a general purpose test control and data acquisition interface module are generally described. A number of computerized ultrasonic data displays of pulse echo flaw data, relative attenuation, and ultrasonic velocity data for a flywheel constructed of a Kevlar-Epoxy composite are included to illustrate the capabilities of the system in ultrasonically characterizing a material. ERA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N78-16772 Oklahoma Univ., Norman.
SATELLITE STRUCTURE IN THE PHOTOELECTRON SPECTRA OF RARE GASES, SOME SIMPLE GASEOUS MOLECULES, AND ALKALI METAL HALIDES Ph.D. Thesis
David Paul Spears 1973 106 p
Avail: Univ. Microfilms Order No. 77-21408

The satellite structure observed in the photoelectron spectra of the inner shells is consistent with the sudden approximation. The satellite structure in the outer shell photoelectron spectra of Ar, Kr, and Xe are found to be due mainly to configuration mixing. The satellite structure associated with the outer shell photoelectron spectra of the alkali and metal ions are compared with those of the isoelectronic rare gases. Also, a study is made of the inner orbitals of nitric oxide, nitrous oxide and water using Mg K alpha X-rays for irradiation. The energy separations of the satellite lines are compared with monopole-allowed states of the neutral molecule and of an isoelectronic ion. Finally, the photoelectron spectrum of the valence shells of nitrogen is studied using a Zr M zeta characteristic X-ray as a photon source.
Dissert. Abstr.

N78-16773 Arizona State Univ., Tempe.
THEORETICAL INVESTIGATION OF LASER INDUCED UNIMOLECULAR DISSOCIATION Ph.D. Thesis
Habibullah Raiszadeh 1977 182 p
Avail: Univ. Microfilms Order No. 77-23636

The unimolecular dissociation lifetime of the sulfur hexafluoride molecule in an intense radiation field was calculated and the quasiequilibrium theory used to determine the lifetimes of one through nine photons in excess of the dissociation threshold, and the translational energy of fragments resulting from the dissociation. A model for the decomposition of polyatomic molecules by multiphoton absorption of pulsed laser irradiation was constructed and applied to the selective collisionless dissociation of a sulfur hexafluoride molecule in a strong pulsed CO2 laser field. Threshold energy and the dependence of the dissociation rate on the intensity of the laser radiation were determined, which show a good agreement with the experimental results. Dissert. Abstr.

N78-16774 Virginia Polytechnic Inst. and State Univ., Blacksburg.
AN EXPERIMENTAL STUDY OF THE ROTATIONAL DISTRIBUTION OF N2(+)B (v) STATES EXCITED BY ELECTRON BEAM IMPINGEMENT UPON HELIUM AND NITROGEN GAS MIXTURES Ph.D. Thesis
John Cameron Hoppe 1977 138 p
Avail: Univ. Microfilms Order No. 77-24513

Many of the atomic helium states are excited by inelastic collisions. That excitation may be induced by various methods, including gas discharges, flowing afterglows, and electron beams. The first negative nitrogen bands were observed with relatively high intensity from small quantities of nitrogen in helium, also induced by such methods. These bands were studied by passing 26 keV electrons through mixtures. The resolved rotational spectra of the (0,0) and (0,1) bands were analyzed as functions of pressure and mixture. An observed enhancement of the intensities has been interpreted in terms of selectively enhanced N2(+)B rotational state populations. The particular hellium species responsible for the enhancement are discussed. Experimental results are compared with a general phase space approach for calculating the reaction cross sections. Dissert. Abstr.

N78-16775 Case Western Reserve Univ., Cleveland, Ohio.
THE MOLECULAR AND SUPERMOLECULAR STRUCTURE OF CELLULOSE 2 Ph.D. Thesis
Francis John Kolpak 1977 201 p

Avail: Univ. Microfilms Order No. 77-25171

The structure and morphology of regenerated and mercerized cellulose were studied by X-ray diffraction and electron microscopy. The crystal structure consists of a array of antiparallel chain molecules. The X-ray analysis utilized the intensity data for regenerated Fortisan and mercerized cotton fibers, and employed rigid-body least-squares refinement techniques. The structures for regenerated and mercerized celluloses are identical, within experimental error. The morphology of highly mercerized cotton is fibrillar and similar in appearance to native cotton. However, ultrasonic treatment disrupts the mercerized cotton microfibrils into a fibrous network connected at numerous points. The fibrous units comprising this network have widths in the range 20 to 100 A and appear to be very flexible, in contrast to the stiff 35 A wide elementary fibrils found in native cotton.

Dissert. Abstr.

N78-16776 Notre Dame Univ., Ind.
THE PHASE TRANSITION PROPERTIES OF HOMOGENEOUS AND INHOMOGENEOUS SQUARE-WELL FLUIDS Ph.D. Thesis
King Uy Co 1977 148 p
Avail: Univ. Microfilms Order No. 77-23534

The Yvon-Born-Green and Kirkwood equations for a system of hard spheres are found to have multiple solutions over broad ranges of density. The extension of these findings to systems of square-well molecules is discussed. The results are interpreted in the framework of a bifurcation theoretical analysis. The behavior of the unexpanded YBG equation for the square-well fluid in the vicinity of the liquid-vapor critical point region is analyzed. The critical point is located, and the critical exponents are determined. The q squared (x) data evolving from a reciprocal temperature perturbation treatment in the context of the YBG theory are used in conjunction with stability criteria to locate the liquid-vapor and solid-liquid coexistence regions. The results offer encouragement for the use of perturbation approximations in delineating coexistence regions. Dissert. Abstr.

N78-16777 Brandeis Univ., Waltham, Mass.
THE HARTREE APPROXIMATION IN QUANTUM FIELD THEORY Ph.D. Thesis
Laurence Frederick Abbott 1977 186 p
Avail: Univ. Microfilms Order No. 77-22803

The Hartree approximation is applied to quantum field theories in order to study properties of the vacuum at zero and finite temperatures and features of the bound-state and resonance spectra which cannot be investigated by conventional perturbative techniques. The Hartree approximation appears as the leading term of a 1/N expansion of O(N) and U(N) symmetric models and so should be valid for large values of N regardless of the coupling strength. In studying the vacuum, it was found that spontaneous symmetry breaking cannot occur for any values of the mass and coupling constant at any temperature. This result, surprisingly different from that of the conventional perturbative approach, is due to effects involving an essential singularity in the coupling constant. Particle propagators are computed and display bound-state and resonance poles for 'strong coupling' parameter values. Inverse scattering techniques are introduced to solve the Hartree equations in two spacetime dimensions and a rich semiclassical boundstate spectrum appears. These powerful techniques are also extended to the four-dimensional case. In addition, gauge field corrections to the Hartree approximation are considered. Dissert. Abstr.

N78-16778 California Univ., Los Angeles.
THE STUDY OF P + He-4 ELASTIC SCATTERING USING ALPHA BEAMS AT EQUIVALENT PROTON KINETIC ENERGIES OF 400 MeV AND 1.05 GeV Ph.D. Thesis
Jorge Vergara Geaga 1977 150 p
Avail: Univ. Microfilms Order No. 77-23861

Alpha particle beams with kinetic energies of 1.6 GeV and 4.2 GeV incident on a liquid hydrogen target were used to measure P + He(4) elastic scattering. Both outgoing particles were detected in coincidence. The forward going alpha particle was identified and detected in a magnetic spectrometer. The recoiling proton was detected in a recoil counter array. Elastic momentum and scattering angle and coplanarity constraints were applied to the data in the analysis. Simple Glauber calculations made are unable to simultaneously fit both the first minimum and the second maximum of either measured distribution.

Dissert. Abstr.

N78-16779 Washington Univ., St. Louis, Mo.
STUDIES OF MOLECULAR STRUCTURE AND PHOTOCHEMICAL REACTIVITY Ph.D. Thesis
Ronald Lee Yates 1977 235 p
Avail: Univ. Microfilms Order No. 77-26881

A theoretical approach to the effect of nonbonded interactions on molecular structure is presented. The one electron molecular orbital theory is used to show that bonded interactions can favor sterically congested geometries in contradistinction to the traditional view of organic chemists. A general procedure for evaluating the relative magnitude of hyperconjugative effects is described. For those cases where the interacting fragments are lone pairs and bonds, the magnitude of hyperconjugation is found to be a function of geometrical orientation. Specifically, it is shown that lone pair-bond and bond-bond hyperconjugation is greatest when an anti geometrical relationship between the dominantly interacting fragments obtains. A model for photocycloadditions based on qualitative potential energy surfaces is proposed. Dissert. Abstr.

N78-16780 Louisiana State Univ. and A&M Coll., Baton Rouge.
ELECTRONS IN FLUIDS. ELECTRON TRANSFER REACTIONS Ph.D. Thesis
Margaret Jean Logan 1977 329 p
Avail: Univ. Microfilms Order No. 77-25390

Localized excess electron states in ammonia and water were studied using a semicontinuum model which consists of the excess electron, its nearest neighbor solvent molecules and a dielectric continuum. A comparison of some theoretical results with experimental properties shows that theoretically calculated changes in the optical transition energy with variations in temperature and pressure are qualitatively in agreement with experimental results. The location of of the higher excited states of the localized electron are predicted as are modifications of the model. A theory of outer sphere electron transfer reactions in polar solvents is developed which utilizes the same division of solvent into solvation layer and continuum. A quantum mechanical expression for the electron transfer probability is derived which predicts a temperature dependent activation energy in many cases. Dissert. Abstr.

N78-16781# Nagoya Univ. (Japan). Inst. of Plasma Physics.
THE MASS DEPENDENCE OF THE SPUTTERING YIELD-SURFACE CORRECTION
Masatoshi Imada Nov. 1977 32 p refs
(IPPJ-311) Avail: NTIS HC A03/MF A01

A simple model is used to study the dependence of the sputtering yield on the incident atomic number z sub 1. Scatterings between incident and target atoms are classified into two types, that is, large and small angle scatterings. Large angle scatterings are represented by random walk with a certain energy loss and small angle scattering by another certain energy loss without refraction. The range distribution derived from this model rather well agrees with other rigorous calculations. Using the above simple model, the sputtering yeild can be explained as the surface correction, i.e., as the effect of the escaping of energetic atoms from the surface. Author

N78-16782# California Univ., Livermore. Lawrence Livermore Lab.
HIGH PRESSURE APPARATUS FOR HYDROGEN ISOTOPES TO PRESSURES OF 345 MPa (50,000 psi) AND TEMPERATURES OF 1200 DEG C
John F. Lakner 8 Jun. 1977 17 p refs Presented at 6th AIRAPT Intern. High-Pressure Conf., Boulder, Color., 25-29 Jul. 1977
(Contract W-7405-eng-48)
(UCRL-78886; Conf-770706-4) Avail: NTIS HC A02/MF A01

A functional high pressure, high temperature apparatus for hydrogen isotopes which uses an internally heated pressure vessel within a larger pressure vessel is described. The pressure capability is 345 MPa (50 K psi) at 1200 C. The gas pressure inside the internal vessel is balanced with gas pressure in the external

vessel. The internal vessel is attached to a closure and is also the sample container. The sample container together with the closure can easily be removed and loaded under argon using standard glove-box procedures. The small volume of the inner vessel permits small volumes of gas to be used, thus increasing the sensitivity during pressure-volume-temperature (PVT) work.
ERA

N78-16783# California Univ., Livermore. Lawrence Livermore Lab.
TIME FOR ATOMIC AND MOLECULAR DATA BASES IS NOW (AN OVERVIEW OF DATA MANAGEMENT RESEARCH AT LLL)
V. E. Hampel and E. A. Henry 1 Feb. 1977 47 p refs Presented at the Advisory Group Meeting on Atomic and Molecular Data for Fusion, Abingdon, Oxfordshire, United Kingdom of Great Britain and Northern Ireland, 1 Nov. 1976
(Contract W-7405-eng-48)
(UCRL-79286; Conf-761123-4) Avail: NTIS HC A03/MF A01

Numerical data bases of atomic and molecular (A and M) data required for laser-induced fusion studies were created. One file contains primarily atomic energy levels and atomic transition data released by Charlotte E. Moore in NBS publications. The second file is based on the spectroscopic constants for more than 1000 molecular levels of approximately 160 heteronuclear diatomic molecules prepared by S. N. Suchard. Additional data bases are contemplated in support of the accelerating research activities in these fields. The present paucity of authenticated, computer-readable A and M data is not unlike that observed two decades ago in nuclear fission research. ERA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N78-16784 Massachusetts Univ., Amherst.
INVESTIGATIONS IN HADRON PHYSICS: BOUND STATE MODELS FOR FERMONS; RADIATIVE CORRECTIONS TO PION-PION SCATTERING Ph.D. Thesis
Francesc Serra Roig 1977 169 p
Avail: Univ. Microfilms Order No. 77-26435

Trajectories of fermion Regge poles are calculated in a model in which a spin 1/2 particle is bound to a spin 0 core. The Bethe-Salpeter equation in the ladder approximation provides a relativistic description of the model in which a fundamental interaction is unitarized. Results are obtained numerically from a covariant separable approximation to the kernel of the partial-wave integral equation. Two kinds of interactions are considered: the single particle exchange kernel and an exponentially damped kernel. A chiral SU(2)XSU(2) Lagrangian is used to describe low-energy pion-pion scattering. Radiative corrections are calculated by modifying in a guage invariant way the strong interaction Lagrangian in the presence of the electromagnetic field. Corrections to the cross section are calculated to 0 (alpha). Dissert. Abstr.

74 OPTICS

Includes light phenomena.

N78-16785 Michigan State Univ., East Lansing.
LIGHT SCATTERING SPECTROSCOPIC STUDIES OF SILICONE FLUIDS Ph.D. Thesis
Katherine Emily Reed 1977 133 p
Avail: Univ. Microfilms Order No. 77-25280

A Brillouin light scattering spectroscopic study of both linear and cyclic polydimethylsiloxane liquids was undertaken to examine the effect of polymer chain length on various spectral parameters. Eight fluids were investigated at seven temperatures between 20 C and 85 C. The refractive index, Brillouin shift frequency and full Brillouin linewidth at half-height were obtained experimentally. These properties were found to be linearly decreasing functions of temperature for all fluids. The sonic velocity, adiabatic compressibility and sound absorption coefficient were calculated and also found to vary linearly with temperature for each silicone. Dissert. Abstr.

N78-16786 Columbia Univ., New York.
STUDIES IN THE VISIBLE REGION OF NITROGEN DIOXIDE Ph.D. Thesis
Rodrick Wallace 1977 149 p
Avail. Univ. Microfilms Order No. 77-24130

Both time and energy resolution of fluorescence, induced by narrow bandwidth pulsed excitation from a tunable dye laser, was used to analyze non exponential fluorescence from excitation of nitrogen dioxide. Two exponential decays were found at different wavelengths. The shorter originates from an identified 2B2 rovibronic level, the longer from a spectroscopically unknown state, possibly the Renner perturbed remains of the 2B1 (K unequal to 0) state. An estimate is given of the importance of the long lifetime state as a mechanism of resonance fluorescence relaxation, for this particular wavelength and bandwidth of excitation. Somewhat narrower pulsed excitation from the same laser system was used to study magnetic field-induced depolarization of nitrogen dioxide fluorescence (Hanle effect), without energy resolution of the fluorescence.
Dissert. Abstr.

N78-16787 Ohio State Univ., Columbus.
COMPUTER ASSISTED PROCESSING OF INFRARED SPECTRA AND BAND OF C2H2 AND C2HD AT 1.1 MICRONS Ph.D. Thesis
Jan Edward Adams 1977 176 p
Avail: Univ. Microfilms Order No. 77-24589

The details are presented of new technology to assist in processing infrared spectra. The high resolution experimental data gathered for the acetylene and monodeuterated acetylene molecule in the 1.1 micron wavelength region are also discussed. A system to assist the spectroscopist in analyzing infrared spectra in order to find vibration rotation term values and compute molecular constants have been programmed. This program has been tested on an IBM System 370, Model 168 computer. The system can produce graphic displays on a teleprocessing terminal. The user can then interact by extending the assignment of the rotational structure and request the calculation of more accurate molecular constants. The system allows easy entry of new observations. Effective use of this system improves the speed and accuracy of processing infrared spectra. Dissert. Abstr.

N78-16788 Pennsylvania State Univ., University Park.
AN INVESTIGATION OF THE DIGITAL RESTORATION OF CODED APERTURE IMAGES FORMED USING COMPTON SCATTERED X-RAYS Ph.D. Thesis
Richard Gerard Sider 1977 111 p
Avail: Univ. Microfilms Order No. 77-23275

The system employed throughout the experimental work utilized Compton scattered X-rays as the information carrying radiation and the Fresnel zone pattern as the encoding aperture. All decoding was accomplished using this method. A thorough analysis of both the encoding and decoding processes is included, with primary attention being given to various formulations of the diffraction equation. The use of a particular formulation of the diffraction equation, which resulted in improved scaling of the output image, is demonstrated. A factor of two to three increase in the image size is noted over images obtained using the previously employed techniques. Gray scale modification, amplitude filtering, and inverse filtering are investigated as possible methods for improving the quality of the output image. A complete anaysis of each method is presented along with a demonstration of its effect. Dissert. Abstr.

N78-16789*# Hyperfine, Inc., Fairport, N.Y.
RESEARCH DIRECTED TOWARD IMPROVED ECHELLES FOR THE ULTRAVIOLET Final Report, 11 Nov. 1975 - 10 Nov. 1976
2 Sep. 1977 39 p refs
(Contract NAS5-22859)

(NASA-CR-156681) Avail: NTIS HC A03/MF A01 CSCL 20F

Research was undertaken to demonstrate that improved efficiencies for low frequency gratings are obtainable with the careful application of present technology. The motivation for the study was the desire to be assured that the grating-efficiency design goals for potential Space Telescope spectrographs can be achieved. The work was organized to compare gratings made with changes in the three specific parameters: the ruling tool profile, the coating material, and the lubricants used during the ruling process. A series of coatings and test gratings were fabricated and were examined for surface smoothness with a Nomarski Differential Interference Microscope and an electron microscope. Photomicrographs were obtained to show the difference in smoothness of the various coatings and rulings. Efficiency measurements were made for those test rulings that showed good groove characteristics: smoothness, proper ruling depth, and absence of defects. The intuitive feeling that higher grating efficiency should be correlated with the degree of smoothness of both the coating and the grating is supported by the results. Author

N78-16790*# Utah Univ., Salt Lake City.
OPTICAL FIBER WAVEGUIDE SAGNAC INTERFEROMETER. PHASE 1: MULTITURN ONE METER DIAMETER, SINGLE MODE Final Report
Victor Vali 2 Dec. 1977 29 p refs
(Contract NASw-2967)
(NASA-CR-155574) Avail: NTIS HC A03/MF A01 CSCL 20F

A rotating ring interferometer was constructed using a 100 meters of single mode optical fiber wound on a crystal cylinder. A 20 inch diameter fiber interferometer gyroscope was built and its sensitivity was evaluated. Major noise sources were identified and improvements for the next phase of development were determined. The accuracy of .01 of a fringe can be improved to .0001 by the removal of the noise source. A.R.H.

N78-16791# National Bureau of Standards, Washington, D. C.
MEASUREMENT PROCEDURES FOR THE OPTICAL BEAM SPLITTER ATTENUATION DEVICE BA-1 Final Report
B. L. Danielson May 1977 24 p refs Sponsored by Aerospace Guidance and Meteorology Center, Newark Air Force Station, Ohio
(PR-272358/3; NBSIR-77-858) Avail: NTIS HC A02/MF A01 CSCL 20F

Measurement procedures are described for the step attenuation of laser beams up to 44 db using a specially constructed attenuator box (BA-1). With the use of an additional preattenuator beam splitter, the attenuation range can be extended to over 70 db. The BA-1 system is designed for use at .6328 micrometer, .5145 micrometer, and 1.06 micrometer. The attenuation ratios of these wavelengths are calculated values. An analysis of the estimated uncertainties is also given. GRA

N78-16792# Washington Univ., St. Louis, Mo. Lab. for Applied Electronic Sciences.
COUPLING OF SINGLE-MODE OPTICAL FIBERS TO GaAs WAVEGUIDES Final Report, 1 Feb. 1976 - 31 Dec. 1977
William S. C. Chang, Bhushan L. Sopori, and Thomas Monsees Jun. 1977 171 p refs
(Contract F19628-76-C-0032; ARPA Order 3020)
(AD-A046284; RADC-TR-77-200) Avail: NTIS HC A08/MF A01 CSCL 20/6

The object of this research contract is to find an efficient method to couple a single-mode optical fiber to a GaAs waveguide at near infrared wavelengths. The general approach chosen is to first fabricate a transitional waveguide. The fiber and the transitional waveguide are then coupled together by the tapered velocity coupling method. Technologies were developed and excellent results have been obtained in using the r.f. sputtering process with a cleaved GaAs mask to step-etch the GaAsP waveguides. This process followed by the R.F. deposition of SiO2 buffer layer and by deposition of either BaO2 glass or AZ1350 waveguiding layer on top of the SiO2 layer has led to very high coupling efficiency (80%) between the primary waveguide and the transition waveguide. Research on the deposition of sodium glass was undertaken to obtain the transition from uniform planar waveguide to channel waveguide. These results demonstrated that highly efficient fiber to thin film waveguide coupling can probably be realized by this method. Additional research is needed in order to demonstrate a complete coupling system. Author (GRA)

N78-16793# ITT Cannon Electric, Inc., Santa Ana, Calif.
CONNECTORS FOR OPTICAL FIBER TDM CABLES Semiannual Report, 7 May 1976 - 30 Jun. 1977
Ronald L. McCartney Nov. 1977 78 p refs
(Contract DAAB07-76-C-1357)
(AD-A047055; ECOM-76-1357-1; SAR-1) Avail: NTIS MF A01 CSCL 09/1

This report describes the development of a single fiber alignment system for use in a six-channel hermaphroditic fiber optic connector. The connector will be used to interconnect a strengthened six-channel fiber optic cable. Included in this report are the test results, conclusions and recommendations of all ferrule and alignment designs which have been investigated to date. GRA

N78-16794# Hughes Research Labs., Malibu, Calif.
COMPONENTS FOR SINGLE STRAND MULTIMODE FIBER SYSTEMS Scientific Report, 3 Jan. - 3 Jul. 1977
M. Barnoski, B. Chen, H. R. Friedrich, S. Jensen, and E. Marom Aug. 1977 42 p refs
(Contract F19628-77-C-0103)
(AD-A047315; RADC-TR-77-284; SR-1) Avail: NTIS HC A03/MF A01 CSCL 20/6

The development of a technique for the determination of the geometrical characteristics of a taper pulled in a fiber is described in this report. This technique uses the deflection of a light beam due to the taper. The insertion loss of a taper has been experimentally investigated as a function of the modal index of the fiber both with the taper immersed in air and a high index fluid (diiodomethane). The results of these experiments show that the higher order modes are more easily out-coupled by the taper than the lower order modes. GRA

N78-16795# Sperry Research Center, Sudbury, Mass.
MULTIPLEXING AND FILTERING OF OPTICAL SIGNALS Final Report, 29 Apr. 1976 - 29 Apr. 1977
Arthur R. Nelson Jun. 1977 99 p refs
(Contract DAAB07-76-C-1343)
(AD-A047224; SCRC-CR-77-40; ECOM-1343-F) Avail: NTIS HC A05/MF A01 CSCL 20/6

The objective of this contract is to develop an optical multiplexing device to combine onto one channel the information carried on several separate fiber optic channels and, subsequently, to perform the demultiplexing operation after transmission over distances of the order of a km. The main research effort is the development of the optical multiplexing/demultiplexing device. This device must be compatible with multimode fibers of relatively large numerical aperture, exhibit total throughput losses less than 15 db, total signal to crosstalk ratio of more than 20 db, and a bandwidth capability of 1.3 MHz. This report covers the work performed during a one year effort beginning May, 1976. During the past year a complete multiplexed optical data link that meets nearly all of the criteria outlined above has been constructed and tested. The main effort centered on the development of the actual electro-optic multiplexing device itself, a thin crystal of LiTaO3 that controls the flow of light with the application of appropriate voltages. Several designs were constructed and tested before the final design was chosen. The final multiplexer design exhibited less than 15 db throughput loss, and operates at high frequency with up to .25 numerical aperture fibers. The inherent signal to crosstalk ratio is about 15 db, 5 db less than the requested performance. Following the construction of the devices, permanent fiber-to-device connections were developed, and the complete multiplexer and demultiplexer units were packaged with integral butt coupled fibers. This is the first reported development of an optical switch with fibers produced as a permanent package. GRA

N78-16796# Texas Instruments, Inc., Dallas. Central Research Labs.
ACTIVE Al SUB x Ga SUB 1-X As DEVICES FOR WAVEGUIDE CIRCUITS Final Technical Report, 3 Feb. 1975 - 31 May 1977

A. R. Reisinger, D. W. Bellavance, J. C. Campbell, and K. L. Lawley Oct. 1977 57 p refs
(Contract N00014-75-C-0501)
(AD-A047194; TI-08-77-39) Avail: NTIS HC A04/MF A01 CSCL 20/6

Etched mesa double heterojunction GaAs/GaAlAs lasers were fabricated. Evanescent field coupling into an underlying (Ga/Al)As planar waveguide was achieved with 25% coupling efficiency. Selectively grown 1-bar mesa lasers were also successfully end-fire coupled into curved grown (Ga, Al)As waveguides with 35% efficiency. Waveguide structures capable of channeling light around curves were investigated. Experiments indicate that, with current technology, an optimum radius of curvature is in the 1.27 to 2.54 mm (50 to 100 mil) range. Below 1.27 mm, radiation losses were found to increase very rapidly. (Ga, Al)As active devices compatible with monolithic laser sources were developed. A new structure design, which includes a thin (approx. 3000 A) GaAs cap, permits the fabrication of electroplated Pt Schottky barrier pads without significantly increasing the optical losses in the 8500 to 9000 A wavelength range. Electrooptic directional coupler switches were made. A 17 db extinction ratio in the coupled channel was measured at a reverse bias voltage of -25 V. Single-line, metal-gap modulators were also demonstrated with a modulation depth of 88% at a peak voltage of -25 V. These types of devices were successfully integrated with a 90 deg curved section of an ion-milled rib waveguide with a radius of curvature of 1.016 mm (40 mils). The major source of loss was the curve itself, which accounted for 17 db of attenuation. GRA

N78-16797# Fairchild Imaging Systems, Syosset, N. Y.
NIGHT SOLID STATE IMAGING CAMERA (RPV) Final Technical Report, 29 Sep. 1976 - 31 May 1977
K. A. Hoagland 24 Jun. 1977 88 p refs
(Contract DAAK70-76-C-0253)
(AD-A047146; ED-AX-83) Avail: NTIS HC A05/MF A01 CSCL 17/8

This report describes the results of a program to provide the first phase of development of a day/night imager suitable for application in a Remotely Piloted Vehicle (RPV) being developed by the U.S. Army. Major objectives defined for the first phase development have been achieved, specifically: (1) A television camera which demonstrates feasibility of the Night Solid State Imager approach has been designed, fabricated, tested and delivered. The performance of the demonstration camera meets or exceeds initially defined program requirements. (2) Design details have been defined for a day/night camera system replacement for the present (Phase IV) daylight vidicon imager used in the Aquila RPV program. A description of the proposed Aquila retrofit design is contained in section 5.0 of this report. The sensor system utilized to achieve program objectives consists of a high performance Image Intensifier coupled by fiber optics to a Fairchild CCD-488 image sensor. The CCD-488 is a solid state photosensitive device with 380 x 488 elements, specifically designed for application as a low light level TV image sensor. GRA

N78-16798# Stanford Univ., Calif. Center for Materials Research.
GENERATION OF COHERENT VUV AND SOFT X-RAYS Semiannual Report, 1 Jan. - 30 Jun. 1977
S. E. Harris and J. F. Young Jul. 1977 22 p refs
(Contract N00014-75-C-1175)
(AD-A047049; SU-CMR-77-7; SU-SAR-4; SU-GL-2718) Avail: NTIS HC A02/MF A01 CSCL 20/6

The goal of this program is the development of practical sources of coherent vacuum ultraviolet radiation. During this reporting period two primary projects have been active. The first is the production of coherent radiation at the Lyman alpha wavelength of 1218 A. Such radiation is potentially applicable to the diagnosis of plasmas, such as those studied under the nuclear fusion program. The second project has elucidated the factors which limit the efficiency of the process 3547 A yields 1182 A in Xe, and suggests solutions. Details of the research are presented in the following sections. GRA

N78-16799# Michigan Univ., Ann Arbor. Dept. of Electrical and Computer Engineering.
INVESTIGATION OF INTERFEROMETRIC WAVEGUIDES Final Report, Apr. 1974 - Mar. 1977
E. N. Leith, G. C. Kung, S. K. Case, W. Y. Wang, and T. J. DiLaura May 1977 128 p refs
(Contract N00014-67-A-0181-0058)
(AD-A041213; FR-2) Avail: NTIS HC A07/MF A01 CSCL 09/1

The guiding of waves in interferometrically produced waveguides is investigated. A very general technique of analysis was developed. Computer calculations based on this approach were used to study leakage from guiding channels and the effect of pulse shape. Experimental devices were constructed. A new concept, modular optics, was conceived. Author (GRA)

N78-16800# National Bureau of Standards, Washington, D. C. Inst. for Basic Standards.
GEOMETRICAL CONSIDERATIONS AND NOMENCLATURE FOR REFLECTANCE Final Report
F. E. Nicodemus, J. C. Richmond, J. J. Hsia, I. W. Ginsberg (Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.), and T. Limperis (Agro Sci., Inc.) Oct. 1977 70 p refs
(PB-273439/0; NBS-MN-160; LC-77-22966) Avail: NTIS HC A04/MF A01 CSCL 20F

A unified approach to the specification of reflectance, in terms of both incident- and reflected- beam geometry, is presented. Nomenclature to facilitate this approach is proposed. GRA

N78-16801# Advisory Group for Aerospace Research and Development, Paris (France).
OPTICAL FIBRES, INTEGRATED OPTICS AND THEIR MILITARY APPLICATIONS
H. Hodara, ed. (Tetra Tech, Inc., Pasadena, Calif.) Oct. 1977 563 p refs Partly in ENGLISH and FRENCH Proc. of the Electromagnetic Wave Propagation Panel/Avionics Panel Joint Symp., held at London, 16-20 May 1977
(AGARD-CP-219; ISBN-92-835-0206-X) Avail: NTIS HC A24/MF A01

Developments in fiber and integrated optics are reviewed stressing their military applications, in areas of communication and data transmission. Emphasis is placed on avionics, electromagnetic wave propagation, end devices, coupling and propagation mechanisms, and optical cables and systems. For individual titles, see N78-16802 through N78-16851.

N78-16802# Naval Electronics Lab. Center, San Diego, Calif.
REVIEW AND ASSESSMENT OF FIBER OPTICS FOR MILITARY APPLICATIONS
Henry F. Taylor *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 18 p refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

Component technology, system design considerations, and military applications of optical fiber communications are reviewed. The basic components include optical transmission lines, transmitters, receivers, repeaters, connectors, and bus couplers. Characteristics of these devices which have a particular bearing on military usage, such as environmental and radiation effects, are emphasized. Recent results representative of the state-of-the-art in component technology are indicated. Factors which affect the selection of components for a particular system are discussed. The most important of these are cable length, analog or digital signal bandwidth, system environment, reliability requirements and cost constraints. Some of the options available in selecting components to meet these system criteria include compound glass or silica fibers, fibers with step index or graded index profile, single fiber or multifiber cables, light emitting diode or injection laser sources, and PIN or avalanche photodiode detectors. Some of the military systems applications include digital point-to-point links and multi-terminal busses for ships, aircraft, and land bases, secure systems for voice and video, tactical land-line telemetry links, and undersea cables for transmitting sonar signals. In each application area, the proven or anticipated benefits of using fiber optics are discussed. Author

N78-16803# Bell Telephone Labs., Inc., Holmdel, N. J.
REVIEW OF INTEGRATED OPTICS

H. Kogelnik *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 10 p refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

A tutorial introduction and a review is given of the field of integrated optics and optical waveguide devices. Device principles and potential applications are discussed. The properties of dielectric waveguides are reviewed briefly and new materials and new fabrication techniques are mentioned. Research on waveguide modulators and switches with focus on devices made by titanium diffusion in lithium niobate is discussed. Mention is made of an experimental 4 x 4 switching network which was recently demonstrated in the laboratory. Other devices discussed are corrugated waveguide filters in which rejection bandwidth from 0.1 to 6 A were obtained. The use of waveguide techniques in semiconductor junction lasers is considered. Author

N78-16804# Service Technique des Telecommunications de l'Air, Paris (France).
THE FUTURE OF FIBER OPTICS WITH REGARD TO MILITARY AERONAUTICAL APPLICATIONS [L'AVENIR DES FIBRES OPTIQUES POUR LES APPLICATIONS AERONAUTIQUES MILITAIRES]
P. Lecat *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 9 p refs In FRENCH (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

Some of the following items are discussed in detail: (1) the evolution of border materials; (2) the effect of electromagnetic perturbations on transmission lines; (3) transmission development by fiber optics; and (4) linkage feasibility by fiber optics.
Transl. by B.B.

N78-16805# Naval Undersea Center, Kailva, Hawaii.
RECENT PROGRESS IN OPTICAL FIBER CABLES FOR USE IN THE OCEAN
G. A. Wilkins and R. A. Eastley (Naval Electron. Lab. Center) *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 17 p refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

Physical and optical test results are given for several undersea, low loss, optical and electro-optical cable units. Diameters for these cables range from 1.0 mm to 17.5 mm, and all were designed to operate in environments of high tensile, bending and hydrostatic stresses. Design constraints necessary to isolate the optical fibers from such stresses are described. Design details and rationales are given for each cable unit. Continuing technical problems and probable solutions are discussed. Author

N78-16806# Royal Aircraft Establishment, Farnborough (England). Space Dept.
FIBRE-OPTICS FOR DEFENCE APPLICATIONS IN THE UK
B. Ellis and W. S. Nicol (Ministry of Defense, London) *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 3 p refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

The philosophy underlying the choice of particular types of fiber optic systems for military applications is discussed. Some existing and planned systems are described together with details of supporting component development. Author

N78-16807*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A REVIEW OF NASA FIBER OPTICS TASKS
Alan R. Johnston *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 14 p refs (For availability see N78-16801 07-74)
(Contract NAS7-100)
Avail: NTIS HC A24/MF A01 CSCL 20F

The status of on-going NASA tasks involving fiber optic data transmission, and related topics is given. Ground based applications, including a multiplexed wideband 2 km prototype link and a building-to-building video link, are described. In connection with the use of fibers in space, the effects to be expected from the space environment are touched on, particularly radiation darkening of fibers and temperature effects. Laboratory results on performance of fibers at cryogenic temperatures are also presented. Finally, some thoughts on future applications are given. Author

N78-16808# Technische Universitaet, Brunswick (West Germany). Inst. fuer Hochfrequenztechnik.
FUNDAMENTAL MODE SIGNAL TRANSMISSION IN SINGLE- AND MULTIMODE FIBRES
K. Petermann and H.-G. Unger *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 12 p refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

Signal transmission in signal-mode operation of single and multimode fibers is considered. Choice of emission wavelength and of the refraction index profile is discussed in relation to residual distortion. It is shown that the propagation is distorted by random bends as introduced by the cabling process. Therefore a microbending loss occurs, which, however, becomes negligible as long as the fundamental mode spotsize is kept small. In addition the conversion of energy to higher order modes due to microbending and its reconversion distorts pulses in the fundamental mode. This pulse distortion is kept small by sufficiently attenuating the higher order modes or by inserting discrete mode filters. Simple analytic design considerations are given. Author

N78-16809# Polytechnic Inst. of New York, Farmingdale. Dept. of Electrical Engineering and Electrophysics.
BEAM EVOLUTION ALONG A MULTIMODE OPTICAL FIBER
S. Y. Shin and L. B. Felsen *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 17 p refs (For availability see N78-16801 07-74)
(Contract F44620-69-C-0047; Grant NSF ENG-7522625)
Avail: NTIS HC A24/MF A01

Results for the phase and amplitude of the beam field as it progresses down the fiber via successive reflections from the core interface are presented. The analysis is performed by first formulating the fields generated in the fiber by a point source and then converting these fields to beam fields by assigning a complex value to the source coordinates. It is shown that paraxial Gaussian beam fields are calculable completely from corresponding point-source-excited fields in a geometric optical ray bundle. It is found that the beam projection on the fiber cross section refocuses between reflections but that the beam divergence increases when the number of reflections from the fiber wall is sufficiently large. Numerical results are presented for beams injected in a meridional plane. Author

N78-16810# ITT Electro-Optical Products Div., Roanoke, Va.
TESTING OF TENSILE STRENGTH OF OPTICAL FIBER WAVEGUIDES
C. Kao, M. Maklad, and J. E. Goell *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 3 p (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

A procedure is developed which enables the tensile strength of an optical fiber waveguide to be predicted along its length. The influence of surface flaws on high stress concentration and failure of a stressed fiber in tension is considered along with fatigue or stress corrosion caused by moisture. The flaw distribution is characterized in order to define the statistical value of the fiber tensile strength of one test gauge length to that of another with known confidence limits. The test procedure consists of a short length test coupled with a proof test at about twice the service strength. For fibers made for high strength, this procedure allows high production yield as well as a guaranteed strength specification. For fibers made without special precautions, this procedure could be adopted, but the fiber yield may be unacceptably low. J.M.S.

N78-16811# Plessey Radar Ltd., Havant (England). Radar Research Centre.
COLOUR MULTIPLEXING TECHNIQUES AND APPLICATIONS IN OPTICAL WAVEGUIDE LINKS
David A. Kahn *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 5 p refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

The feasibility of color multiplexing is established by a review of the currently available components, namely sources, detectors, waveguides, and color splitting/combining devices. Operational systems employing color multiplexing are described. Finally, an

assessment of the technique and the identification of the most likely application areas are given. Author

N78-16812# Communications Research Centre, Ottawa (Ontario).
AN EXPERIMENTAL OPTICAL-FIBER LINK FOR THE COMMAND AND CONTROL SYSEM 280
Elmer H. Hara and H. Claire Frayn *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 17 p (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

The development of an experimental optical fiber link for the command and control system (CCS-280) for the DDH-280 destroyer escorts of the Canadian Navy is described. The viability of optical fiber transmission systems in combat action data systems such as the CCS-280 is demonstrated. The experimental optical fiber link, located between two situation display consoles, consisted of 31 channels transmitted the digital signals between the two consoles. Single optical fibers were used for each transmission channel, some of which carried time division multiplexed signals at a maximum bit rate of 10 Mb/s. The optical fibers were enclosed in an armored sheath to form a cable of approximately 2.5 cm in diameter and 4 m in length. Experimental trials were carried out on a land-based CCS-280. When acceptance tests established for the CCS-280 itself were applied to the optical link, the tests were satisfied with zero defects and the optical link performed satisfactorily under simulated combat conditions. Author

N78-16813# Naval Underwater Systems Center, New London, Conn.
MULTICHANNEL FIBER OPTIC SONAR LINK (FOSL-1)
Frederick C. Allard and Norman S. Bunker *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 7 p refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

A fiber optic transmission line was designed, built, and tested at sea in an operational sonar system. This inboard transmission line conducts 52 channels from a preamplifier bank to a beamforming section. Plastic fiber optics is used in a 61-channel cable. Optical connectors are utilized at two levels. Commercially available electro-optical components are employed in the line driver and line receiver designs to achieve wide dynamic signal range with low distortion at low cost. The transmission line, designated FOSL-1 (Fiber Optics Sonar Link-No. 1) was designed as an initial step toward a military qualified subsystem. The utilization of established technologies, the modular construction, and case of maintenance allow for extended hands off operation by sonar technicians who are not specially trained for fiber optics. Author

N78-16814# ITT Electro-Optical Products Div., Roanoke, Va.
A TWO KILOMETER OPTICAL FIBER DIGITAL TRANSMISSION SYSTEM FOR FIELD USE AT 20 Mb/s
T. A. Eppes, J. E. Goell, and R. J. Gallenberger (Naval Electronics Lab. Center) *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 9 p (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

A two-kilometer optical fiber digital transmission system for bit rates up to 20 Mb/s is described. The system includes a light emitting diode optical source, an avalanche photodiode receiver, and multifiber graded index cable. The data channel elements are connected via several field installable optical connectors. The design and performance of such components as transmitter modules, receiver modules, optical cable, and field installable optical connectors are discussed. Author

N78-16815# Shape Technical Center, The Hague (Netherlands). Communications Div.
COST MODEL FOR AN OPTICAL FIBRE COMMUNICATIONS SYSTEM
T. A. Alper *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 13 p refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

A cost model is derived for an optical fiber communications system. The normalized costs of such systems is presented for several modulation schemes. Reasonable assumptions are used in developing the model and its application are confined to transmitters that have LED sources and use parabolic index fiber cables. For the purposes of calculation, a signal to noise ratio requirement of 70 db is assumed for analog systems, an error rate requirement of 10 to the -9th power is assumed for digital systems, and modulation rates are assumed not to exceed 100 Mbits/s. The costs per channel per kilometer for a typical short haul system and for a typical long haul system are derived to illustrate the use of the model. Author

N78-16816# Naval Electronics Lab. Center, San Diego, Calif.
A-7 ALOFT ECONOMIC ANALYSIS AND EMI-EMP TEST RESULTS
R. A. Greenwell and G. M. Holma *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 13 p refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

Cost projections for three performance-equivalent cable alternatives: coaxial, twisted-shielded pair, and fibre optic were developed. These cost projections were generated by an approach which utilizes two techniques; one which computes very specific costs of research and development (R&D), investment, and operation and support (O&S) for the data transmission links, and the other which computes total weapon systems cost of R&D, investments, and O&S resulting from the inclusion of the field-operation systems. The results clearly indicated definite economic benefits with fiber optics. Tests were also performed to determine EMI susceptibility and EMP effects on fiber-optic and wire interconnects for the A-7 navigation and weapon delivery subsystem (NWDS). These tests were performed in the laboratory and on the aircraft. Results from the EMI and EMP tests have shown that the A-7 ALOFT fiber-optic subsystem is less susceptible to EMI and greatly reduces electromagnetic induction from an induced transient pulse. Author

N78-16817# Sperry Research Center, Sudbury, Mass.
DEVICE AND SYSTEM CONCEPTS FOR MULTIMODE SINGLE FIBER OPTICAL DATA LINKS
D. H. McMahon, A. R. Nelson, and H. Wichansky (Army ECOM, Fort Monmouth, N. J.) *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 10 p refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

The principle of internal reflectance at grazing incidence is used to create devices for controlling guided multimode light by electro-optic means. The feasility of multiple switching is demonstrated through the construction and evaluation of a variety of devices including modulators, couplexers, and multiplexers. Such devices add impetus to the growth of the multimode single fiber technology by presenting new opportunities for system design. Author

N78-16818# Naval Research Lab., Washington, D. C.
SINGLE MODE FIBER OPTICS AND INTEGRATED OPTICS FOR USE IN OPTICAL COMMUNICATIONS
T. G. Giallorenzi and A. F. Milton *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 18 p refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

The status of components for use in single mode fiber and integrated optical communication systems is presented. The single mode coupling problems are stressed because couplers and splicers are the technological items which pace the implementation of single mode data transfer systems. Author

N78-16819# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
ELECTROOPTICAL ACTIVE COMPONENTS FOR GUIDED LIGHT
M. Papuchon *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 8 p refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

Phase modulators, amplitude modulators, and switches that use the electro-optical effect are discussed. Waveguide fabrication through diffusion of titanium in LiNb13 crystals and component performance are considered. J.M.S.

N78-16820# Westinghouse Research Labs., Pittsburgh, Pa.
GIGA-HERTZ MODULATORS USING BULK ACOUSTO-OPTIC INTERACTIONS IN THIN FILM WAVEGUIDES
Gerald B. Brandt, M. Gottlieb, and R. W. Weinert *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 9 p refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

When bulk acoustic waves are applied to an optical waveguide, several modulation effects are observed depending upon the type of wave (longitudinal or shear). Longitudinal sound waves frequency-shift the guided light, thus providing a means of modulating light in a wide variety of waveguide materials. Using thin film mosaic acoustic transducer technology, such modulation is demonstrated at frequencies in the gHz region. By segmenting the acoustic transducer electrodes, the same arrangement can be used for deflecting the light since the acoustic field sets up a time varying grating whose spatial frequency is set by the segment spacing. Theoretical frequency limitations on these devices do not appear to be important until approximately 30 gHz is reached, thus they are potentially useful for extremely wide-band data links. Experiments at 1.5 gHz show 30% bandwidth of acoustic modulation using optical heterodyne detection. Author

N78-16821# California Univ., Berkeley. Dept. of Electrical Engineering and Computer Sciences.
DISTRIBUTED-BRAGG-REFLECTOR INJECTION LASERS FOR INTEGRATED OPTICS
Shyh Wang *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 18 p refs (For availability see N78-16801 07-74)
(Contract N00014-75-C-0420; Grant NSF ENG-76-08292)
Avail: NTIS HC A24/MF A01

The underlying principles and the fabrication and operation of the distributed-Bragg-reflector (DBR) injection laser, a novel semiconductor laser which shows great promise as a source for integrated optics are described. The laser uses two corrugated waveguides at the ends as reflectors. First, the effect of periodic thickness variation on wave propagation is reviewed and the dispersion relation for the eigen Bloch wave is presented. This presentation is followed by a derivation of the reflection and transmission coefficients of the periodic-waveguide (or Bragg) reflector. Then the fabrication procedures and the operation of a DBR GaAs-Ga1-xAaxAs laser are described. The performance of the laser is analyzed and ways to optimize the design of the laser for single mode operation with appreciable output power are discussed. Finally, possible schemes for future integration with other optical components and for direct coupling into optical fibers are proposed. Possible ways to fine tune and to stabilize the laser wavelength are also suggested. Author

N78-16822# University Coll., London (England). Dept. of Electrical and Electronic Engineering.
MULTIMODE OPTICAL SYSTEMS-POWER COUPLING BETWEEN WAVEGUIDES
M. G. F. Wilson, C. W. Pitt, A. D. DeOliveira, and O. Parriaux *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 9 p refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

Theoretical and experimental results are presented for multimode optical waveguide intersections fabricated by an ion-exchange technique. A simple ray theory is used to derive the power division and mode conversion, both of which are influenced greatly by the geometry in the intersection region. Author

N78-16823# Washington Univ., Seattle. Dept. of Electrical Engineering.
LASER-FIBER COUPLING WITH OPTICAL TRANSITION STRUCTURES
Gordon L. Mitchell and William D. Scott *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 11 p refs Sponsored by Navy and NSF (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

An optical transition fiber is used to couple between a diode laser and a single-mode fiber. Coupling optimization is detailed in terms of fiber size and refractive index. Fabrication techniques and material selecting parameters for rectangular fibers used to make the transitions are discussed. Author

N78-16824# Office of Naval Research, Arlington, Va.
AN INTEGRATED OPTICAL ANALOG-TO-DIGITAL CONVERTER
D. C. Lewis and H. F. Taylor (Naval Electronics Lab. Center, San Diego, Calif.) *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 10 p refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

An electro-optic technique for analog to digital conversion based on an interferometric intensity modulator is analyzed. The advantages are compared with alternative methods. Potential military applications are discussed including signal processing for wideband radar and electronic warfare systems. J.M.S.

N78-16825# Consiglio Nazionale delle Ricerche, Florence (Italy). Istituto di Ricerca sulle Onde Elettromagnetiche.
THIN FILM INTEGRATED SIGNAL PROCESSORS
G. C. Righini, V. Russo, and S. Sottini *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 14 p refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

Planar and hemispherical geodesic lenses are described. The aberrations of the hemispherical correlator were studied and numerical examples were carried out to verify its Fourier transform capabilities. Two and three level transmission filters were considered in the numerical simulation of pattern recognition operations. It is concluded that the hemispherical correlator can be used as an optical processor with aperture and field angles suitable for application to integrated optical circuits. J.M.S.

N78-16826# California Univ., Los Angeles. Electrical Sciences and Engineering Dept.
HOW DOES ONE INDUCE LEAKAGE IN AN OPTICAL FIBER LINK
C. Yeh and A. Johnston *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 5 p refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

Nondestructive methods to induce the leakage of optical signals from optical fibers are discussed: (1) the index-matching-fluid method; (2) the temperature method; and (3) the bending method. Experiments were performed. Results show that all three methods are effective in inducing leakage from plastic clad fibers while only the bending method is effective for glass-clad fibers. Author

N78-16827# Centre National d'Etudes des Telecommunications, Lannion (France).
STUDY AND RESULTS OF FIBER OPTICS TRANSFER FUNCTIONS [ETUDE ET RESULTATS DE LA FONCTION DE TRANSFERT DES FIBRES OPTIQUES]
R. Bouille, J. C. Bizel, and M. Guibert *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 8 p refs In FRENCH (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

A method of obtaining the transfer function modulus of fiber optics was discussed. It consists of utilizing two Fourier transformations at the speed of continuous luminous impulses. Experimentation as well as results obtained of different types of fibers were reviewed. It was concluded that the possibilities of linkage by fiber optics can be accomplished according to diverse numerical flow. Transl. by B.B.

N78-16828# Plessey Co. Ltd., Towcester (England). Allen Clark Research Centre.
DETAIL RESOLUTION IN OPTICAL FIBRE INDEX PROFILING METHODS
W. J. Stewart *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 2 p refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

The resolution of fine structure in fiber refractive index profiles by near field profiling methods was investigated experimentally and theoretically. The standard near field method and a new improved method are treated. The significance of this structure

in affecting fiber bandwidth is described and the results qualitatively explained in resolution terms. The concept of mode volume is introduced. Author

N78-16829# Bell Telephone Labs., Inc., Holmdel, N. J.
NOVEL TECHNIQUE FOR MEASURING THE INDEX PROFILE OF OPTICAL FIBERS
J. A. Arnaud and R. M. Derosier *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 8 p refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

A novel technique for measuring the refractive index profile of optical fibers is demonstrated. The method consists of illuminating a small area of the fiber core and measuring the total transmitted power. The transmission of leaky modes is accounted for. The index profiles of germania-doped fibers obtained by this technique are compared to interferometric measurements. The resolution is shown to be limited by wave optics effects. Author

N78-16830# JENAER Glaswerk Schott and Gen., Mainz (West Germany).
INFLUENCE OF THE REFRACTIVE INDEX PROFILE ON THE TRANSMISSION QUALITY OF GRADIENT INDEX OPTICAL FIBRES
G. Gliemeroth, D. Krause, N. Neuroth, and F. Reitmayer *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 7 p refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

The problems occurring in the manufacture and investigation of fibers with the refractive index profile, required by theory, are described. The fiber core consists of multi-component-glasses and is produced by the method of inside coating of a glass tube and subsequent collapsing and drawing. The refractive index profile is determined by an interferometric method and by measuring the near field intensity distribution. The pulse broadening is measured directly. The influence of different profiles on the pulse broadening is demonstrated. Typical properties of the fibers are given: total loss: < 5 dB/km at the wavelength 850 nm; pulse broadening: 1...3 ns/km; numerical aperture: 0.2...0.3. Author

N78-16831# Queen Mary Coll., London (England).
TRANSMISSION CHARACTERISTICS OF GRADED INDEX FIBRES
P. J. B. Clarricoats, J. M. Arnold, and G. Crone *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 15 p refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

Computational methods by which the propagation characteristics of a fiber, hence the impulse response and system bandwidth may be determined are compared. A computer program which determines for a model of a laser source, the excitation of modes in an arbitrarily graded refractive index fiber is described. Author

N78-16832# Consiglio Nazionale delle Ricerche, Florence (Italy). Instituto di Ricerca sulle Onde elettromagnetiche.
DISPERSION EVALUATION IN MULTIMODE FIBERS BY NUMERICAL TECHNIQUE: APPLICATION TO RING SHAPED AND GRADED INDEX WITH A CENTRAL DIP
A. M. Scheggi, P. F. Checcacci, and R. Falciai *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 16 p refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

A method is described which utilizes ray tracing techniques and modal relations to evaluate the dispersion characteristics of multimode optical fibers with various refraction index distributions. The possibilities offered by the method are shown by application to fibers with index distribution ranging from the quasi step to the quasi parabolic shape. Then the method is applied to ring profiles and graded index profiles with a central dip. Dispersion equalization properties are observed for some types of ring profiles, while the effect on the dispersion due to a central dip in a graded profile is examined by varying the depth and width of the dip. Author

N78-16833# California Inst. of Tech., Pasadena.
FINITE-BANDWIDTH PROPAGATION IN MULTIMODE OPTICAL FIBERS
B. Crosignani, P. DiPorto, and C. H. Papas *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 6 p (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

The propagation in a multimode optical fiber of a finite-bandwidth optical carrier modulated by a nonstationary signal is investigated. The fluctuations of the field due to random mode-coupling are considered and the set of coupled equations describing their evolution is derived. The propagation of a frequency-modulated signal is investigated. A general theorem concerning the asymptotic behavior of mode-power fluctuations is obtained. Author

N78-16834# Army Electronics Command, Fort Monmouth, N.J.
INJECTION LASER TRANSMITTER FOR LONG DISTANCE FIBER OPTICS COMMUNICATION
Ernst Schiel, Gerald Talbot, and Henry Kressel (RCA Labs, Princeton, N. J.) *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 10 p refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

The design and development of an injection laser transmitter for a tactical long distance fiber optics communication link are described. The double heterostructure GaAlAs laser is configured in a triple-stripe geometry which can feed the optical output power into a linear array of three fibers. The laser structure was grown by the liquid phase epitaxial method and optimized for high peak power operation at a duty factor of ten percent. (Average pulse repetition rate is 10 MHz and pulsewidth is 10 nsec.) The laser chip is mounted in a prototype pill package, which is placed on a thermoelectric heater/cooler keeping the operational temperature of the laser at 15 C. A special drive circuit utilizing a high power field effect transistor in the last stage was designed to drive the laser at a peak current of 2 A to obtain 250 mW peak output power. Efficient coupling into graded index fibers was accomplished by lensing the fibers by a new technique. Life tests on three lasers showed no degradation after 7000 hours of operation. Author

N78-16835# Lincoln Lab., Mass. Inst. of Tech., Lexington.
GaInAsP/InP DOUBLE-HETEROSTRUCTURE LASERS FOR FIBER OPTIC COMMUNICATIONS
J. J. Hsieh *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 p 35-1 - 35-7 refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

The performance of broad-area and stripe geometry GaInAsP/InP double heterostructure diode lasers prepared by liquid phase epitaxy was studied. These lasers have the advantage that exact lattice matching between the GaInAsP active region and the InP substract is possible for quaternary alloy compositions giving emission wavelengths over a range that includes 1.1-1.3 mm, the optimum region for optical communication systems utilizing fused silica fibers. Continuous operation at room temperature was achieved in this region both for proton defined-stripe (PDS) and junction defined buried-stripe (JDBS) lasers. Near field observations of the JDBS lasers show total optical confinement, with no spreading of the radiation outside the buried stripe for cw operation at 20% above threshold or for pulsed operation at 8 times threshold. Three PDS devices have logged over 2000, 1600, and 1200 hours of cw operation at room temperature without any degradation in output power, threshold current, or emission spectrum. Author

N78-16836# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
REPRODUCTION MANUFACTURING OF LASERS DIODES [REPRODUCTIBILITE DE FABRICATION DES DIODES LASERS]
E. Duda, J. C. Carballes, and J. Apruzzese *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 p 36-1 - 36-9 refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

The results of a study performed with the aim of improving the reproducibility of laser diodes are presented. The lasers diodes designed are of double heterostructure type, grown on GaAs

substrates; they have an emitting stripe of 12 mm wide formed by a shallow proton implantation. At each important step of production (deposition of obraic contact, cleaving, sawing, bonding) tests were set up to check the quality of the operation. The influence of these operations on the characteristics of the lasers is discussed. The influence of the stresses induced during the process is pointed out. Criteria were derived to eliminate at an early stage the chips which exhibit insufficient characteristics for optical communication applications. As a general result a reduction in the dispersion of the performances was achieved for the lasers produced through these tests set up along the production line. Author

N78-16837# Naval Ocean Systems Center, San Diego, Calif.
PHYSICS AND TECHNOLOGY OF DEGRADATION IN GaAs LIGHT EMITTING DIODES
G. Zaesehmar *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 p 37-1 - 37-7 refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

Creep-induced lattice defects caused by thermal stress in the junction area are examined as a possible source for light emitting diode degradation. It is indicated that the increased number of lattice defects causes an increase in nonradiative recombination centers, resulting in a shunt path which decreases the efficiency at constant current. A quantitative theory and experimental results are discussed. Author

N78-16838# Standard Telecommunication Labs. Ltd., Harlow (England).
RELIABLE SEMICONDUCTOR LASERS FOR WIDE BAND OPTICAL COMMUNICATION SYSTEMS
A R Goodwin, P R Selway, M Pion, and W O Bourne *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 p 38-1 - 38-8 refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

The fabrication and performance characteristics of stripe geometry lasers are described. These lasers are shown to be suitable for use with small core single mode or graded-index fibers in systems requiring modulation at rates in excess of 250 Mbit/s. J.M.S.

N78-16839# Technische Universitaet, Munich (West Germany).
DESIGN AND FABRICATION OF GaAs LIGHT EMITTING DIODES FOR OPTICAL COMMUNICATION SYSTEMS WITH HIGH TRANSMISSION CAPACITY
W. Huber, J. Heinen, and W. Harth *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 p 39-1 - 39-4 (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

The physical mechanism of the time and frequency behavior of LED's is investigated. It is demonstrated that two time constants, the electron life time and the time constant due to the diode's space charge capacitance, govern the high frequency performance of a LED. A model is presented which describes the influence of the relevant technological LED parameters (layer structure, active area, active layer width and doping) on the time and frequency behavior by means of these time constants. The technological and physical factors, which represent the ultimate limitation of the modulation bandwidth, are discussed. Based upon this model, the design concept of a practical LED with a very high modulation bandwidth is described. Measurements of the frequency characteristic, the light power output, and the spectral characteristic were carried out. In addition the AM-noise behavior is investigated. The transmission rate and the maximum length of an optical communication system using such high speed LED's is estimated. Author

N78-16840# Laboratoires de Marcoussis (France).
HIGH POWERED SILICON AVALANCHE DIODES FOR OPTICAL COMMUNICATION SYSTEMS [PHOTODIODES A AVALANCHE AU SILICIUM A GRANDE RAPIDITE POUR SYSTEMS DE COMMUNICATIONS OPTIQUES]
G. Ripoche and M. Brilman *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 p 40-1 - 40-16 refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

Silicon avalanche photodiodes are the best detectors adapted to answer to the need of optical communications. Two diode structures were studied; (1) classical p-n junctions, and (2) p-n-p junctions obtained by high energy ion implantation. Each structure can be obtained by homogeneous substrate or epitaxial substrate studied performance functions. A description of utilization procedure for the two structures is presented along with results obtained concerning utility gain, sensitivity, and speed. The results are then compared with obtained data and surveyed in detail.
Transl. by B.B.

N78-16841# Allen Clark Research Centre, Towcester (England).
THE RELIABILITY OF HIGH RADIANCE GaAs LEDS
S. D. Hersee *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 p 41-7 - 41-11 refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

Extended life testing of diffused junction LED's revealed that degradation is due to two independent processes. Evidence is presented which indicates that both of these processes are diffusion controlled. On the basis of these results the room temperature life time of a typical LED is predicted to be approximately 10 hours. Author

N78-16842# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
EMISSION MODULE OF A SEMICONDUCTOR LASER [MODULE D EMISSION A LASER SEMICONDUCTEUR]
A. Jacques and L. Dauria *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 p 42-1 - 42-13 refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

Problems regarding the design and the fabrication of an injection laser transmitter module are discussed. The emitter unit and the driving and control circuits are considered. Author

N78-16843# Laser Diode Labs., Inc., Metuchen, N. J.
INJECTION LASER SOURCES FOR FIBER OPTIC COMMUNICATIONS
Robert B. Gill *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 p 43-1 - 43-13 (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

The fabrication and performance characteristics of injection lasers and light emitting diodes currently being developed for use in fiber optics communication or data link systems are described. Emphasis is placed on device design and GaAs and GaAlAs epitaxial and wafer processing technology currently in use for the routine manufacture of commercial light emitting diodes and high duty cycle or CW room temperature injection laser diodes. Therefore, the device performance results which are discussed are typical of manufactured devices rather than the best results observed in the laboratory. While the processing technology which is described is based on the fabrication of cw room temperature laser diodes, the processing techniques detailed are also applicable to the manufacture of double heterojunction light emitting diodes as well as large optical cavity, high power, high duty cycle laser diodes. Author

N78-16844# University Coll., London (England). Dept. of Electrical Engineering.
HOLOGRAPHIC ELEMENTS FOR PRACTICAL FIBRE BUNDLE COUPLERS
O. D. D. Soares, A. M. P. P. Leite, and E. A. Ash *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 p 44-1 - 44-13 refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

The use of a holographic element, which substantially reduces the sensitivity to tolerance errors in the manufacture of a coupler is discussed. The approach is based on the use of a hologram output window for the cable end, the coupling between the two windows proceeding by means of pseudo-plane waves. The effects is transfer the need for precision to the factory, the coupler to be assembled in the field being relatively undemanding. The system is applicable to bundles of fibers; preliminary experimental results for the coupling between one pair of fibers to another pair are described. Author

N78-16845# Allen Clark Research Centre, Towcester (England).
AN ADJUSTABLE BRANCHING COUPLER/ATTENUATOR FOR MULTIMODE SINGLE FIBRE SYSTEMS
C. Stewart and W. J. Stewart *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 10 p refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

Two forms of the coupler/attenuator are studied. The first consists of a block of clear plastic material with an amplitude grating on one surface against which the fiber is pressed. The fiber assumes the shape of the grating which is approximately sinusoidal. Power from the fiber is coupled out into the plastic medium and may be detected at the end face. The second form of the device consists of a thin glass plate of about the same thickness as the fiber with a grating formed on one edge. The plate is shaped such that the emerging radiation from the coupling region is focussed on to a detector or another fiber. Results are reported for both types of coupler. Author

N78-16846# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
BIDIRECTIONAL CENTRAL COUPLERS FOR LINKS WITH OPTICAL FIBER BUNDLES
L. Dauria and A. Jacques *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 11 p refs (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

A range of compatible and detachable devices for links with optical fiber bundles were developed including both components for point to point links (transmitter, receiver, connectors ...) and data distribution devices (3dB splitter, electrically tapped connector, mechanical multiple switch). Bidirectional central couplers having seven input/output terminals, compatible with all realized devices are described. Construction of two types of central couplers is described: assembled bundle coupler and separable bundle coupler (with linear central fiber and U central fiber). A technique using a central diffuser allows a significant and reproductible decrease of the maximum variation of the detected levels on the same detecting channel. Author

N78-16847# Laboratoires de Marcoussis (France).
T-COUPLER FOR MULTIMODE OPTICAL FIBERS
L. Jeunhomme and J. P. Pocholle *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 13 p refs Sponsored by Delegation Generale a la Recherche Sci. et Tech. (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

The device described allows the derivation of a variable amount of the light travelling in a multimode optical fiber without interruption of the transmission link. The principle of the optical fiber tap is to induce well controlled mode conversion between guided and radiation modes of the fiber, which can then leak out in a higher-index surrounding medium and reach a photodetector. The mode conversion is induced by bending the fiber in a sinusoidal way and the derivation ratio is adjusted by varying the amplitude of the sinusoidal deformation. The results presented concern the influence of the mechanical wavelength of the deformation, the radiation of the power derivated from the fiber and the influence of the device on the propagation characteristics of the fiber (far-field radiation pattern and impulse response). Results concerning the derivation ratio achievable with this device are also presented for both step-index and graded-index fibers. Author

N78-16848# Siemens A.G., Munich (West Germany).
DATA BUS SYSTEM WITH SINGLE MULTIMODE FIBERS
F. Auracher and H. H. Witte *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 7 p refs Sponsored by Federal Dept. of Res. and Technol. of the Federal Rep. of Ger. (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

The concept is reported of a single fiber data bus-system in T-structure based on a new access coupler which is easy to fabricate and has a low insertion loss. The maximum possible number of terminals that can be supplied with an optimized system were calculated. Author

N78-16849# Standard Telecommunication Labs. Ltd., Harlow (England).
AN OPTICAL FIBRE, MULTI-TERMINAL DATA SYSTEM FOR AIRCRAFT
J. G. Farrington and M. Chown *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 12 p refs Sponsored by Ministry of Defense (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

As a result of a study on the potential of optical fiber multiterminal data systems for avionics, a design approach was chosen which is expected to be a suitable basis for a wide range of applications. This is a time division multiplexing system, which has features of being highly immune to problems of optical loss and multipath effects in optical highways having redundant paths, and of avoiding the need for any master terminal. This system approach is tailored to characteristics of optical fibers, and should lead to good integrity and ruggedness. A breadboard model of a terminal was demonstrated. Author

N78-16850# Hellermann-Deutsch, East Grinstead (England).
FIBRES OPTICS CONVECTORS: HOT FORMING VERSUS EPOXY BONDING OF BUNDLES AND NEW TECHNIQUES WITH SINGLE FIBRES
R. B. Quarmby *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 7 p ref (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

The requirements of fiber optics for military use are reliability, ease of maintenance and speed of both installation and repair. Various single and multichannel connectors and systems for cable-cable and cable-diode coupling can be made, and with suitable design will withstand temperature cycling, humidity, vibration and shock to military standards. Until now fiber bundle cables were terminated by epoxy resin bonding, but this technique has been inconvenient to apply in the field. A new dry technique was developed for hot forming the cable ends and details are given. The new process results in junctions of higher optical efficiency and it can be carried out with only a few minutes' training in the use of the portable tools now available. Butt jointed single fiber connectors were made and have coupling losses in the order of 3db. Author

N78-16851# ITT Components Group Europe, Leeds (England).
FIBRE OPTICS INTERCONNECTION COMPONENTS
J. D. Archer *In* AGARD Opt. Fibres, Integrated Optics and Their Mil. Appl. Oct. 1977 8 p (For availability see N78-16801 07-74)
Avail: NTIS HC A24/MF A01

A range of single fiber demountable connectors and active devices are described, and measured performances are compared with theoretical predictions. Author

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N78-16852 California Univ., Los Angeles.
NONLINEAR COUPLING OF SMALL-AMPLITUDE WAVES IN A PLASMA Ph.D. Thesis
Frederick Peter Blau 1977 104 p
Avail: Univ. Microfilms Order No. 77-23842

A DP device is used to study the nonlinear coupling between a small-amplitude ion wave and a small-amplitude electron wave propagated on a weak electron beam with a directed energy of about 30 volts. The two waves are excited externally, so that both the frequencies and the amplitudes are controllable. Typically, the electron temperature. The ion wave frequency is variable over a wide range of several hundred kilohertz, and its wave potential is two orders of magnitude below the electron temperature. The experimental results are analyzed in terms of a one-dimensional steady-state three-wave interaction model based on a second-order perturbation of the Vlasov-Poisson equations. The resonance conditions on frequency and wave number are verified exactly. The dimensionless value of the matrix

element which couples the waves is much larger than unity. The agreement between the experimental results and the theory is good. Dissert. Abstr.

N78-16853 Colorado Univ., Boulder.
STARK BROADENING IN THE RECOMBINATION PHASE OF A Z-PINCH DISCHARGE Ph.D. Thesis
Sidney Augustus Freudenstein, III 1977 243 p
Avail: Univ. Microfilms Order No. 77-24209

The spectra line widths of the CI 5052 A and Fe I 5383 A lines were measured as a function of electron density and over a small range of temperature. The light source was a linear Z-pinch electrical discharge and the times of measurement were tens of microseconds after the current in the discharge had ceased. Typical plasma conditions were electron density, n sub e x 10 to the 15th power cm superscript-3 and temperature, T is equivalent to 10,000 K. Dissert. Abstr.

N78-16854 Colorado Univ., Boulder.
RADIATION COUPLING OF BERNSTEIN MODES IN RING PLASMAS Ph.D. Thesis
Joseph Murray Hoffman 1977 168 p
Avail: Univ. Microfilms Order No. 77-24229

The behavior of high frequency linear flute modes in a weakly inhomogeneous magnetoplasma is investigated. The two types of plasma of concern here are the ring plasma and the two-component plasma consisting of a cold background with a sparse population of energetic ring plasma. It is found that in such plasmas a highly resonant linear instability exists in those regions of parameter space where the longitudinal electron Bernstein mode and an electromagnetic mode join. In the regions in which these modes couple and become unstable, free energy is taken from the anisotropic electron distribution function and deposited in the wave field. It is shown how these enhanced waves propagate away from these unstable regions and eventually reach the upper hybrid resonance region where they linearly mode convert and become extraordinary waves propagate to the plasma boundary and become the free space radiation.
Dissert. Abstr.

N78-16855 Utah Univ., Salt Lake City.
CONVECTIVE INSTABILITIES IN A CLOSED VERTICAL CYLINDER Ph.D. Thesis
Jerry Michael Olson 1977 105 p
Avail: Univ. Microfilms Order No. 77-23428

A system resembling the various physical and chemical vapor transport configurations of interest to crystal growers was constructed using a closed vertical cylinder with conducting walls heated from below to study convective instabilities in monocomponent gases, nonreactive binary gas mixtures, and a dissociating system. Critical Rayleigh numbers for the onset of various convective modes were determined with a high resolution differential temperature sensing method and flow patterns were deduced from a multiple sensor arrangement. Stable oscillatory modes with a period of 5 sec were found. Dissert. Abstr.

N78-16856 Michigan Univ., Ann Arbor.
THEORETICAL STUDIES OF THE RADIATION-HYDRODYNAMICS OF DEFENSE, LASER-HEATED PLASMAS Ph.D. Thesis
Dwight Paul Duston 1977 209 p
Avail: Univ. Microfilms Order No. 77-26232

A computer simulation code was developed for solving the magnetohydrodynamic (MHD) equations characterizing conservation of mass, momentum, and energy in the plasma, Ohm's Law, and Maxwell's equations for a cylindrically symmetric plasma (assuming no variations in the theta and z directions) as functions of radial position and time. The energy equation is divided into two equations describing both ions and electrons, along with an equation of state for each species. Specific applications examined include: a dense helium Z-pinch plasma, a lithium exploding wire plasma, and a laser-heated aluminum exploding wire plasma. Results from a series of parameter studies are presented and include laser absorption efficiency and laser-to-X-ray conversion efficiencies, as functions of laser pulse width, intensity, and initial wire diameter. Dissert. Abstr.

N78-16857 Stevens Inst. of Tech., Hoboken, N. J.
PLASMA QUIESCENCE IN A REFLEX DISCHARGE Ph.D. Thesis
Leslie Girton Jerde 1977 89 p
Avail: Univ. Microfilms Order No. 77-26937

A thermionic cathode reflex discharge and the plasmas it produces were experimentally investigated. Although the reflex discharge is generally characterized a source of unstable plasma, it was found that extremely quiescent plasmas can be produced in the device. Particle and power balances were obtained for the discharge and the plasma, and the principles of operation of the discharge were established. The plasma potential and both electron energy distribution functions (parallel and perpendicular to the magnetic field) were obtained throughout the plasma column with planar Langmuir probes. Dissert. Abstr.

N78-16858 Wisconsin Univ., Madison.
INFRARED EMISSION AND SCATTERING FROM THE DENSE PLASMA FOCUS Ph.D. Thesis
George Randall Neil 1977 75 p
Avail: Univ. Microfilms Order No. 77-19119

A study of the dense plasma focus was performed using CO2 laser scattering and the infrared bremsstrahlung emission. Although the dense pinch stage of the focus was measured to be overdense for CO2 laser light, the post pinch phase when neutron emission peaks is quite accessible for collective scattering. Measurements of the infrared bremsstrahlung indicated peak densities of 3 x 10 to the 19th power. The spectrum indicated absorption by the return current sheet for wavelengths greater than 6 microns. The collective scattering experiment gave scattering levels of nS sub k = 7 x 10 to the 19th power/cu cm in short spikes near the end of the dense pinch and in the post pinch phase. By arranging an unfavorable scattering polarization, this signal was demonstrated to be due to reflection from small overdense regions. The scattered power indicated a region size on the same order as the size of the well-known micropinches that appear on soft X-ray photographs. Dissert. Abstr.

N78-16859 California Univ., Davis.
ABSORPTION OF FOCUSED LASER BEAMS BY SPHERICAL PLASMA Ph.D. Thesis
Curtis Jon Randall 1977 150 p
Avail: Univ. Microfilms Order No. 77-27404

The interaction of a high intensity axially symmetric beam with a nonspherical plasma is studied numerically. The high frequency plasma response is calculated using a linearized fluid approximation. The full three dimensional Maxwell's equations are solved in spherical coordinates. A method for selectively damping the longitudinal electric fields is included to model thermal kinetic or nonlinear effects near the critical density. The low frequency response of the plasma to the ponderomotive force is followed with an isothermal hydrodynamic description. The incident laser beam is circularly polarized so that the plasma remains azimuthally symmetric to first order. The absorption of an initially spherical plasma can be significantly increased by induced aspherical plasma density profile modifications. The validity of the approximations made is analyzed.
Dissert. Abstr.

N78-16860 California Univ., Davis.
EXPERIMENTAL INVESTIGATION OF MODERATE ENERGY ELECTRON BEAM-PLASMA INTERACTION AND THERMAL ELECTRON HEATING WITH FINITE AMPLITUDE ION DENSITY FLUCTUATIONS Ph.D. Thesis
Ming Fat Sze 1977 107 p
Avail: Univ. Microfilms Order No. 77-27413

In this experiment the collective effects that efficiently transfer electron beam energy into a low density plasma are investigated. A moderately high energy large diameter electron beam is injected into a long cylindrical, unmagnetized, quiescent plasma to produce a high phase velocity electron plasma wave by the well-known two stream instability. The beam excited electron plasma wave grows exponentially and then stabilizes by beam trapping which results in acceleration of beam electrons to lower and higher velocities. As the high frequency spectrum broadens, other plasma nonlinearities involving ion dynamics set in. The electron plasma were parametric decays into a forward propagating ion acoustic wave and an electron plasma wave. Dissert. Abstr.

N78-16861 Maryland Univ., College Park.
DIVERGENCES IN THE KINETIC THEORY OF WEAKLY COUPLED GASES Ph.D. Thesis
Lawrence Ernest Wharton 1976 271 p
Avail: Univ. Microfilms Order No. 77-26575

The time correlation function expression for the coefficient of self-diffusion is considered for a gas where molecules interact with a repulsive pair potential which remains finite as the relative separation of any two particles approaches zero. The expansion of the solution of the classical equations of motion was considered for the system in powers of the pair potential and show that it fails to converge whenever collisions occur which appreciably change the relative velocity of the colliding pair. The binary-collision expansions of the solutions of the equation of motion were analyzed and show that the binary-collision operator can be written as a sum of two terms The results of this analysis were to be applied to the terms which appear in the density expansion of the coefficient of self-diffusion and the three body term was studied in detail for a two-dimensional system. Dissert. Abstr.

N78-16862 Maryland Univ., College Park.
EXPERIMENTAL STUDY OF ION DYNAMICS IN THE MARYLAND FAST THETA PINCH Ph.D. Thesis
Ted Teh-Hsien Chiang 1977 135 p
Avail: Univ. Microfilms Order No. 77-26558

The ion dynamics in a turbulently heated high voltage theta pinch are studied by an electrostatic deflection field energy analyzer to study the axial ion energy and an electrostatic retarding field energy analyzer to study the radial energy. The axial ion energy data shows that ions are lost along the magnetic field lines. The loss mechanism is due to a combination of an axial potential and an axial ion temperature. The radial ion energy data shows two distinct ion peaks identified as the reflected and piston ions. Both ion peaks start out well collimated in the radial direction. As they approach the axis, the reflected ions stay as a beam with a little more thermalization, but the piston ions are much more thermalized with a higher temperature. Results are compared with two hybrid codes, neutron emission, and previous Doppler shift measurements. Dissert. Abstr.

N78-16863 Stanford Univ., Calif.
NONEQUILIBRIUM RADIATIVE TRANSFER THEORY WITH A SELF-CONSISTENT ELECTRON ENERGY DISTRIBUTION Ph.D. Thesis
Edward Charles Shoub 1977 199 p
Avail: Univ. Microfilms Order No. 77-25725

The effects of relaxing the a priori assumption of local thermodynamic equilibrium for the free electrons in a hydrogen plasma were studied. A kinetic equation describing the balance between elastic and inelastic collisions is presented and accurate approximate solutions for the distribution function are obtained. These show that the tail of the distribution is susceptible to distortion for ionization fractions. Expressions for the collision rates are obtained which explicitly display their dependence on the atomic level populations. These expressions are combined with the statistical equilibrium and radiative transfer equations and the following problems are considered: (1) the thermal ionization equilibrium of an optically thin hydrogen gas; (2) the formation of a spectral line by a gas of two-level atoms; and the transfer of radiation through a gas of four-level hydrogen atoms. The effects of atom-atom collisions are considered in the first and third problems. Dissert. Abstr.

N78-16864 Michigan Univ., Ann Arbor.
DYNAMICAL BEHAVIOR OF A MIRROR-CONFINED PLASMA Ph.D. Thesis
David Lawrence Galbraith 1977 140 p
Avail: Univ. Microfilms Order No. 77-26242

The dynamic equations (particle and energy balance) for a mirror-confined plasma are presented, and calculational formulas are given for several of the quantities appearing therein. An isotropic, non-Maxwellian distribution function is assumed for the positive ions, and the calculation of its parameters is described. Formulas are derived, based upon binary collision theory, for calculating the particle and energy confinement of positive ions, the energy exchange rate between species, and the sigma-vee average using this assumed distribution function. The set of balance equations is then solved for an equilibrium condition. This equilibrium depends upon the reactor parameters supplied: mirror ratio, magnetic field strength, reactor size, injection energy and injection angle of the fuel ions, and the ratio of plasma to magnetic pressures. Dissert. Abstr.

N78-16865# Nagoya Univ. (Japan).
INSTITUTE OF PLASMA PHYSICS Annual Review, Apr. 1976 - Mar. 1977
Mar. 1977 158 p refs
Avail: NTIS HC A08/MF A01

Papers are presented on the following topics: (1) experiments on JIPP T-II, a hybrid system of stellarator and Tokamak, (2) nonlinear transport due to collisional drift wave and interpretation of related experiments, (3) plasma confinement of Nagoya high beta toroidal pinch experiments, (4) thermonuclear fusion plasma by lasers coupling and implosion, (5) high-temperature high-quality deuterium plasma production by laser beam(s) and interactions with magnetic field, (6) formation of high current REB ring for plasma confinement in a cusp field with RF Plugging. Author

N78-16866# Nagoya Univ. (Japan). Inst. of Plasma Physics.
OBSERVATION OF FLUCTUATIONS RESPONSIBLE FOR STOCHASTIC ION HEATING IN A TURBULENT PLASMA
Y. Amagishi, H. Iguchi, Y. Ito, and I. Kawabe Oct. 1977 17 p refs
(IPPJ-309) Avail: NTIS HC A02/MF A01

The correlation time and fluctuation level of ion acoustic waves are measured under the condition of turbulent heating using twin capacitive probes. At the anomalously resistive time, the correlation time becomes shorter, typically several periods of ion waves, and the energy density of the waves is of the order of n sub e T sub e. The ion heating rate previously reported is shown to be due to stochastic mechanism. Author

N78-16867# Naval Research Lab., Washington, D. C.
THE EFFECTS OF CROSS-SECTIONAL ELONGATION ON TRAPPED ELECTRON MODES
K. R. Chu, Edward Ott, and Wallace M. Manheimer Sep. 1977 30 p refs
(Contract E(49-20)-1006; NRL Proj. MR-3615)
(AD-A047184; AD-E000000; NRL-MR-3615) Avail: NTIS HC A03/MF A01 CSCL 20/8

The dispersion relation for the trapped electron mode in noncircular cross-section Tokamaks is formulated and evaluated. It is shown that modest reductions in the growth rate result from cross-sectional elongation. Author (GRA)

N78-16868# Japan Atomic Energy Research Inst., Tokyo. Div. of Thermonuclear Fusion Research.
EXPERIMENTS WITH A RESISTIVE MODEL SHELL FOR TOKAMAK APPARATUS
Taro Sometani (Dept. of Elec. Engineering, Shizuoka Univ., Hamamatsu) and N. Fujisawa Aug. 1976 19 p refs In ENGLISH; parts in JAPANESE
(JAERI-M-6689) Avail: NTIS (US Sales Only) HC A02/MF A01; ERDA Depository Libraries

The distribution of image current (shell current) in a resistive model shell was measured. A plasma simulator was in the shell; it was fed with a sinusoidal current of variable frequency. The distributions of shell current at different frequencies were obtained, following the Ampere's law, from signals of the magnetic probes located on internal and external surfaces of the shell. Intensity of the shell current increased as the simulator was displaced outward and the frequency was raised. Intensity of the shell current did not vary as a sinusoidal function of the poloidal angle of the shell. When frequency of the simulator current was raised sufficiently to make thickness of the shell equal to its skin depth, intensity of the shell current became independent of the frequency. The vertical magnetic field produced by the shell current was obtained from signals of the magnetic probes located on the simulator. Intensity of the measured field coincided with that of the vertical magnetic field calculated with the measured distribution of shell current. ERA

N78-16869# California Univ., Livermore. Lawrence Livermore Lab.
REVIEW OF THE MIRROR HYBRID REACTOR

D. J. Bender 4 May 1977 45 p refs Presented at the Proc. of the US/USSR Workshop on Hybrid Reactor Design, Moscow, 14 Mar. - 2 Apr. 1977
(Contract W-7405-eng-48)
(UCRL-79548; Conf-770350-1) Avail: NTIS HC A03/MF A01

The reactor parameters were chosen to minimize the cost of producing fissile fuel for consumption in fission power reactors. The design draws on the experience developed at LLL in previous hybrid reactor conceptual designs and on GA expertise in gas cooling technology and fission reactor mechanical design. ERA

N78-16870# California Univ., Livermore. Lawrence Livermore Lab.
WAVE-BREAKING AMPLITUDES IN WARM, INHOMOGENEOUS PLASMAS
W. L. Kruer 16 Jun. 1977 12 p refs Presented at the Anomalous Absorption Conf., Vancouver, Brit. Columbia, 10-12 May 1977
(Contract W-7405-eng-48)
(UCRL-79604; Conf-770571-1) Avail: NTIS HC A02/MF A01

The effect of plasma temperature on reducing the wavebreaking amplitude of resonantly-driven fields is shown. Some applications to laser fusion are given. ERA

N78-16871# California Univ., Livermore. Lawrence Livermore Lab.
LASER FUSION IMPLOSION AND TARGET INTERACTION PHYSICS
H. G. Ahlstrom and J. H. Nuckolls 19 May 1977 14 p ref Presented at the Conf. on Laser Eng. and Appls., Washington, D.C., 1 Jun. 1977
(Contract W-7405-eng-48)
(UCRL-79540; Conf-770629-5) Avail: NTIS HC A02/MF A01

Laser plasma experiments in implosion and DT gain in laser fusion targets are described. Diagnostic methods were developed for determining the state of the compressed fuel and the plasma processes which are occurring in the absorption and scattering of the laser light incident on the laser fusion pellets. ERA

N78-16872# California Univ., Livermore. Lawrence Livermore Lab.
MAGNETIC FUSION ENERGY
B. McNamara 14 Jun. 1977 51 p
(Contract W-7405-eng-48)
(UCRL-79600) Avail: NTIS HC A04/MF A01

A brief review of fusion research during the last 20 years is given. Some highlights of theoretical-plasma physics are presented. The role that computational plasma physics is playing in analyzing and understanding the experiments is discussed. The magnetic mirror program is reviewed. ERA

N78-16873# Bechtel Corp., San Francisco, Calif.
LASER FUSION HYBRID REACTOR SYSTEMS STUDY
Jul. 1976 114 p refs
(Contract W-7405-eng-48)
(UCRL-13720) Avail: NTIS HC A06/MF A01

The work was performed in three phases. The first phase included a review of the many possible laser-reactor-blanket combinations and resulted in the selection of a demonstration size 500 MWe plant for further study. A number of fast fission blankets using uranium metal, uranium-molybdenum alloy, and uranium carbide as fuel were investigated. The second phase included design of the reactor vessel and internals, heat transfer system, tritium processing system, and the balance of plant, excluding the laser building and equipment. A fuel management scheme was developed, safety considerations were reviewed, and capital and operating costs were estimated. Costs developed during the second phase were unexpectedly high, and a thorough review indicated considerable unit cost savings could be obtained by scaling the plant to a larger size. Accordingly, a third phase was added to the original scope, encompassing the re-design and scaling of the plant from 500 MWe to 1200 MWe (less lasers). ERA

N78-16874# Stanford Univ., Calif. High Temperature Gas Dynamics Lab.
HIGH MAGNETIC FIELD MHD GENERATOR PROGRAM Quarterly Report, Oct. - Dec. 1976
R. H. Eustis, C. H. Kruger, M. Mitchner, S. A. Self, and J. K. Koester Jan. 1977 24 p
(Contract EX-76-C-01-2341)
(FE-2341-1) Avail: NTIS HC A02/MF A01

Technical and programmatic progress on research related to high magnetic field effects in MHD generators is reported. An experiment to determine the possible growth of pressure fluctuations showed a three-fold increase in fluctuation amplitude at 2.4 tesla magnetic field compared to zero field. Experiments with a newly developed forward scatter laser anemometer were successful in measuring the velocity and turbulent intensity in the MHD combustor free jet. Refinements in the temperature measuring technique by line reversal resulted in spatial resolution of 300 microns at distances greater than 500 microns from the surface. Experiments related to the Hall field breakdown problem delineated further the character of fast and slow breakdown corresponding to the origin of the breakdown in the plasma or the insulator. Preliminary work on the disk generator for testing in the six tesla magnet is described. ERA

N78-16875# Westinghouse Electric Corp., Pittsburgh, Pa. Dept. of Fusion Power Systems.
FUSION-DRIVEN ACTINIDE BURNER DESIGN STUDY, VOLUME 1 Final Report
Ronald P. Rose May 1977 316 p refs Sponsored by EPRI (EPRI Proj. 473-1)
(EPRI-ER-451-Vol-1-5-77) Avail: NTIS HC A14/MF A01

The principal characteristics of a beam driven Tokamak fusion-fission hybrid reactor for actinide depletion were developed in this design study. Based on mid-to-late 1980's technology, this reactor provided a fusion neutron wall loading of approximately 1 MW/sq m. The blanket was fueled with residual actinides contained in the high level waste from the LWR-U cycle. These residual actinides were the only fissionable material contained in the fast helium cooled blanket lattice. A principal result of the study was the development of a revised criterion for assessing long term radiotoxic hazard potential from the actinides. This index relates hazard potential from the waste to that of the naturally occurring parent uranium ore from which the wastes were produced. ERA

N78-16876# Westinghouse Electric Corp., Pittsburgh, Pa. Fusion Power Systems Dept.
FUSION-DRIVEN ACTINIDE BURNER DESIGN STUDY, VOLUME 2 Final Report
Ronald P. Rose May 1977 355 p refs
(EPRI Proj. 473-1)
(EPRI-ER-451-Vol-2-5-77) Avail: NTIS HC A16/MF A01

The principal fusion-fission hybrid reactor for actinide depletion was developed in this design study. The blanket is fueled with residual actinides contained in the high level waste from the LWR-U cycle. These residual actinides are the only fissionable material contained in the fast helium cooled blanket lattice and provide sufficient neutron multiplication to given neutron fluxes in the range of 10 to the 15th power n/cm squared-sec. A principal result of the study has been the development of a revised criterion for assessing long term radiotoxic hazard potential from the actinides. This index relates hazard potential from the wast to that of the naturally occurring parent uranium ore from which the wastes were produced. The following topics are discussed: (1) materials technology, (2) thermal and hydraulic design, (3) reactor support systems and balance of plant, (4) environmental and safety considerations, (5) scoping estimates of system cost, and (6) development requirements. ERA

N78-16877# Association Euratom-CEA, Fontenay-aux-Roses (France). Dept. of Physique du Plasma et de la Fusion Controlee.
DIAGNOSTICS USED AT TFR TOKAMAK
Jan. 1977 46 p refs In FRENCH Presented at Natl. Congr. on Plasma Phys., Paris, 6-10 Dec. 1976
(EUR-CEA-FC-877; Conf-761232-2) Avail: NTIS (US Sales Only) HC A03/MF A01; ERDA Depository Libraries

The methods used at the T.F.R. Tokamak (Tokamak Fontenay-

aux-Roses) for determining the principal parameters of the plasma are reviewed: electron density and temperature, ion temperature, density of the neutrals in the discharge and the chemical composition of the plasma. Measurements used for determining the turbulence involved in the plasma are also discussed. These measurements are necessary to explain the energy balance of the plasma confined in the reactor. ERA

N78-16878# Kernforschungsanlage, Juelich (West Germany). Zentrallabteilung Allgemeine Technologie.
LARGE MAGNETIC COILS: DESIGN ACCOMPANYING CALCULATION AND OPTIMIZATION. REGARDING ORTHOTROPIC INTERLAYERS, TEMPERATURE AND ELASTIC SUPPORTS-DERIVATION OF A SPECIAL FINITE ELEMENT
J. F. Stelzer, A. Sievers, and R. Welzel Oct. 1976 80 p refs (Juel-1349) Avail: NTIS (US Sales Only) HC A05/MF A01; ERDA Depository Libraries

Large coils consist of copper layers with glass fiber reinforced resin interlayers inbedded in a strong steel ring. In a first analysis model, the several epoxy layers were condensed to only one the thickness of which is equal to the sum of the single sizes. This fictitious layer was assumed to lie in the middle of the copper and was treated as an orthotropic material. In a following changed model, the epoxy layer was situated between the steel ring and the copper. In this location, the epoxy was suspected to suffer from the highest shear stresses. Both models employed spring trusses as supporting features which simulate the real elastic behaviour of a sustaining vault. Special attention was given (1) to the shear stresses in the epoxy, (2) to the hot and cold states of the coils, and (3) to the forces transferred from the coils to the sustaining vault. An optimal structure design is carried out concerning the steel ring. ERA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N78-16879 Polytechnic Inst. of New York, Brooklyn.
THE METALLIC FIELD EFFECT Ph.D. Thesis
David John Lischner 1977 101 p
Avail: Univ. Microfilms Order No. 77-21077

The metallic field effect (MFE) was determined for four metal-insulator combinations--silver on mica, gold on mica, antimony on mica, and silver on mylar. In this experiment the MFE is the change in conductance due to the periodically induced charge at the interface. Both the first harmonic and the second harmonic response are measured. By measuring the film thickness dependence of the harmonics it is shown that the second harmonic is a volume effect (as opposed to the first harmonic which is a surface effect). For all the samples tested, the second harmonic was virtually eliminated by the clamping. The first harmonic remained a puzzle, though data from the mylar sample tends to support Mazumdar's observations that the first harmonic also has its origin in a charge induced strain, where the strain is localized to the interface. Dissert. Abstr.

N78-16880 Northeastern Univ., Boston, Mass.
FORMAL THEORY OF SCATTERING FROM MANY-BODY TARGETS WITH APPLICATIONS TO LIQUID He4 Ph.D. Thesis
George Megaloudis 1977 133 p
Avail: Univ. Microfilms Order No. 77-24427

A method is presented which enabled one to interpret strong scattering events from many body targets. The method was exact and, as such, its predictions and range of applicability go beyond those of the usual weak scattering (Born) approximations. The application of this technique in solid state physics should yield new and useful results for strong scattering problems. In essence, it was demonstrated that the calculation of strong scattering amplitudes requires the evalution of a generalized current commutator. In the weak scattering regime, retaining only the Born term yielded directly the Plazek-Van Hove correlation formalism which has had very wide application. The solved models of light scattering showed that it was not always difficult to include all orders of perturbation theory. Dissert. Abstr.

N78-16881 Maryland Univ., College Park.
ELECTROREFLECTANCE OF THE LEAD SALTS Ph.D. Thesis
Brian George Rennex 1976 220 p
Avail: Univ. Microfilms Order No. 77-24161

The assignment of optical structures of the lead salts to interband transitions using the technique of electroreflectance is discussed. This experiment exploits the capability to determine the k-space location associated with an optical structure. Both n- and p-samples were investigated at low temperatures over the energy range of 0.3 eV to 7.0 eV. Structures were assigned unambiguously to the L critical point. These L transition energies were then used to test the band structure calculations for the lead salts. Dissert. Abstr.

N78-16882 Maryland Univ., College Park.
OPTICAL STUDIES OF HYDROGEN CHEMISORBED ON SINGLE CRYSTAL TUNGSTEN. PART 1: DIFFERENTIAL REFLECTIVITY. PART 2: COVERAGE MODULATION BY LASER STIMULATED DESORPTION Ph.D. Thesis
James Brian Restorff 1976 125 p
Avail: Univ. Microfilms Order No. 77-24162

Surface reflectance spectroscopy studies of H2 adsorption reveals structure in the differential surface optical conductance. Chemisorption induced modification of the surface density of electronic states of the tungsten as well as additional levels related to the adsorbate are indicated. The use of a repetitively pulsed dye laser to modulate the coverage of gases adsorbed on metallic substrates is examined. Dissert. Abstr.

N78-16883 Syracuse Univ., N. Y.
EFFECT OF IONIZING RADIATION ON THE INFRARED SPECTRA OF POLAR CRYSTALS Ph.D. Thesis
Tovie Leon Rome 1976 209 p
Avail: Univ. Microfilms Order No. 77-24574

Concurrent effects of the ionizing radiation produces in the mid-infrared transmission and far-infrared reflection spectra are studied. Within the limits of the IR-7 spectrophotometer, no transmission modifications were found. It was found, however, that gamma irradiation causes a temporary overall reduction in a crystal's far infrared reflectivity. In a number of crystals a slight radiation induced shift to shorter wavelength was also detected. The latter also decays with time. Doping sodium iodide with thallium reduced the decrease in reflectivity. Models are suggested to account for these observations. The effects themselves are correlated with measurements in the visible and ultraviolet regions. The conclusion is reached that the far infrared spectral alterations are associated with the short term visible coloring. Dissert. Abstr.

N78-16884 Pennsylvania State Univ., University Park.
ELECTRICAL, THERMAL, AND OPTICAL PROPERTIES OF Ag-SiO SUPERLATTICES Ph.D. Thesis
Abdul-Jawad I. Abu-el-Haija 1977 167 p
Avail: Univ. Microfilms Order No. 77-23202

The electrical measurements included the I-V characteristics of the above superlattices at selected temperatures in the temperature range 296-77 K. This part of the study confirmed the existence of negative conductivity states along the direction of the superlattice for electric fields of the order of 105 V/cm. The thermal measurements revealed sensitive resistance temperature dependence as well as resistance temperature switching in the range 290-200 K. The optical properties, meanwhile, involved the measurement of reflectivity, transmissivity, and absorptivity of layer structures. The experimental results were compared with the theoretical values derived from the transfer matrix method. All parameters that were pertinent to the design and preparation of layer structures, such as the identity period, number of layers, and random variation in identity period, were analyzed.
Dissert. Abstr.

N78-16885 Columbia Univ., New York.
ULTRALOW TEMPERATURE EXPERIMENTS WITH A 3He-4He DILUTION REFRIGERATOR. 1: MOESSBAUER STUDIES BELOW 1 DEG K. 2: GAMMA-GAMMA

CORRELATION TEST OF TIME REVERSAL INVARIANCE IN 110Cd Ph.D. Thesis
George Wei Wang 1977 119 p
Avail: Univ. Microfilms Order No. 77-24131

A Mossbauer spectrometer is described which allows the cooling of either the source or the absorber to ultralow temperatures using a 3He-4He dilution refrigerator. Sample temperatures as low as 0.012 K were reached with this system. The application of very low temperatures is of interest for studying certain solid-state properties. It further allows Mossbauer measurements on oriented nuclei, which leads to an absolute thermometer. These possibilities are illustrated by measurements of hyperfine phenomena in FeNH4 (SO4)2 12H2O and K3Fe(CN)6 and of an 57Fe Mossbauer thermometer. A description is given of a time reversal invariance tests measuring the phase angle of the mixing ratio between the E2 and M1 reduced matrix elements through the observation of gamma-gamma directional correlations in 110Cd. The parent nuclei 110mAg were polarized cryogenically using the dilution refrigerator. Three NaI detectors allowed six coincidence combinations to be measured for both the 1505-658 keV and the 1384-(885)-658 keV cascades. Dissert. Abstr.

N78-16886 Northeastern Univ., Boston, Mass.
THEORY OF THE EFFECTS OF LEVEL BROADENING ON THE TRANSPORT AND OPTICAL PROPERTIES OF ELECTRONS IN SOLIDS Ph.D. Thesis
Sung-Churl Han 1976 163 p
Avail: Univ. Microfilms Order No. 77-17786

Within the one electron approximation, these effects were examined for the cases of scattering of the electrons by a random array of scattering centers. The formalism of this theory made use of a projection operator that was introduced in the scattering and interference terms of the quantum kinetic equation based on the work of the shape of the cyclotron power absorption line in semiconductors and extremely high magnetic fields. The peculiar dependence of the linewidth on the impurity concentration was accounted for by this theory. In connection with this new approach to the cyclotron resonance line shape, a number of earlier theoretical works are reviewed critically, and their relations with this theory are analyzed. Dissert. Abstr.

N78-16887 California Univ., Los Angeles.
THE COMPENSATION EFFECT AND RE-ENTRANT SUPERCONDUCTIVITY IN A MAGNETICALLY ORDERED SUPERCONDUCTOR Ph.D. Thesis
Thomas Edward Jones 1977 205 p
Avail: Univ. Microfilms Order No. 77-23882

The Introduction provides a basic history of superconductivity. Both the experimental foundations and the major theoretical advances are described and referenced. The theory needed for this work is developed. The basic BCS solution is outlined, along with its major successes and its shortcomings. This is followed by an outline of, what is referred to here as, the generalized Abrikosov-Gor'kov theory. The experimental techniques needed for this cryogenic work are given. Thermometry and magnetic fields are discussed, as well as the actual procedures used to detect the S-N transition. The Compensation Effect is discussed and the question of the co-existence of super-conductivity and some type of magnetic order is addressed. This observation, that superconductivity vanishes at lower temperatures in a magnetic superconductor, had never been made before this study was initiated. Dissert. Abstr.

N78-16888 Nevada Univ., Reno.
A MOESSBAUER EFFECT STUDY OF IRON COBALT TITANIUM HYDRIDE Ph.D. Thesis
Carl Jan Koizumi 1977 113 p
Avail: Univ. Microfilms Order No. 77-25083

Transmission Mossbauer spectra were collected for the intermetallic hydride FeO.5CoO.5TiH sub x with x greater than or equal to 0 and less than or equal to 1.0 in the temperature range 4.2 K to 294 K, and an interpretation was formulated for these observations. The composition x greater than 0 and less than or equal to 0.1 corresponds to a solid solution hydrogen in the metal known as the alpha phase. The single line Mossbauer spectrum for alpha base material did not differ from the spectrum for Fe0.5Co0.5Ti. This was taken to indicate that the location of metal ions in the alpha phase structure is essentially identical to that in the Fe0.5Co0.5Ti structure (i.e., the unit cell is CsCl type). This conclusion is strengthened by X-ray diffraction data. Dissert. Abstr.

N78-16889 Brandeis Univ., Waltham, Mass.
MOMENTUM DISTRIBUTION MEASUREMENTS IN BERYLLIUM AND ALUMINUM BY COMPTON SCATTERING Ph.D. Thesis
G. Krithivas 1977 171 p
Avail: Univ. Microfilms Order No. 77-22815

Compton profiles for the single crystals of beryllium and aluminum are measured in selected orientations. The data are analyzed to obtain the anisotropies in the profiles and are compared with theoretical as well as previous experimental results. Dissert. Abstr.

N78-16890 Maryland Univ., College Park.
MAGNON RELAXATION AND MAGNON THERMAL CONDUCTIVITY IN NICKEL-IRON ALLOYS Ph.D. Thesis
Bruce Michael Romenesko 1976 106 p
Avail: Univ. Microfilms Order No. 77-24163

A resolution of the frequency dependence of the magnon lifetime in ferromagnetic nickel-iron alloys was attempted. For theoretical comparison, a simple kinetic theory is used. The predictions of three models are compared--the average lifetime model, the s-d exchange model, and the Landau-Lifshitz Gilbert (LLG) model. Measurements were made, in static applied fields of from 2.5 to 24 kOe using the steady-state method with carbon resistors as thermometers; the electrical resistivity was also measured conductivity. The results of these measurements are compared to the predictions of the LLG model. The field dependence of the thermal conductivity is small, making the distinction between the models beyond the precision of the experiment; the precision is limited mainly by uncertainties inherent in the calibration of the carbon thermometers. Nevertheless, the data do confirm the magnon to be a carrier in the thermal transport. Dissert. Abstr.

N78-16891 Maryland Univ., College Park.
EXCHANGE AND CORRELATION IN A TWO DIMENSIONAL ELECTRON GAS Ph.D. Thesis
Richard Alan Rosthal 1977 171 p
Avail: Univ. Microfilms Order No. 77-24165

Many-body and semiclassical methods are used to examine the inversion layer in a metal-oxide-semiconductor system. The leading terms in the expansion of the self energy in powers or r sub s of an electron near the Fermi surface are calculated within the random phase approximation for a high density system. In addition, the total correlation energy is considered within a number of approximations. For the high density case there are the random phase approximation and the Hubbard model as well as the formal perturbation series. The second order contributions are calculated and the non-analytic behavior of higher order terms is examined. It is found that the correlation energy does not diverge in the two dimensional system when the density goes to infinity. At low density, where the interaction energy is dominant, a semiclassical approach is used in which each electron is assumed to be surrounded by a uniformly charged positive disk. An interpolation formula of the form derived by Wigner is obtained from the low and high density results. Dissert. Abstr.

N78-16892 Indiana Univ., Bloomington.
THEORY AND CALCULATION OF ELECTROMAGNETIC PROPERTIES OF STRONG COUPLING SUPERCONDUCTORS Ph.D. Thesis
William Y. Shaw 1977 123 p
Avail: Univ. Microfilms Order No. 77-22674

The behavior of strong-coupling superconductors such as lead in the presence of an electromagnetic (E-M) field has presented a number of problems. First, the experimental data showed a much faster rise in the absorption as a function of frequency at the energy-gap edge (at zero temperature) than was expected. Second, the experimental data for bulk lead at higher frequencies (typical phonon frequencies) exhibited structure not understood in detail. This research work demonstrates both the correctness of the strong-coupling theory of superconductivity and the

important effect of Pippard's nonlocal theory on the results of E-M absorption for bulk superconductors. Dissert. Abstr.

N78-16893 Northeastern Univ., Boston, Mass.
LOW FREQUENCY DIELECTRIC STUDIES OF THE FERROELECTRIC TRANSITION IN THE HYDROGEN-BONDED ARSENATES AND THEIR DEUTERATED ISOMORPHS Ph.D. Thesis
William Bert Spillman, Jr. 1977 293 p
Avail: Univ. Microfilms Order No. 77-24428

The results are given of a low frequency dielectric investigation of the paraelectric-ferroelectric phase transition in the hydrogen-bonded arsenate family and uses these results both to determine fundamental thermodynamic parameters of the materials and to test the internal self-consistency of the current pseudo-spin theories involving them. For all six materials, the thermodynamic order of the transition is determined to be first-order from the dielectric results and the pressure dependence of the transition temperature is also determined. The dielectric results are used to test the recent pseudo-spin theories of hydrogen-bonded ferroelectric materials. The most important result to emerge is that the pseudo-spin theories do not appear to be internally self-consistent when applied to the hydrogen-bonded arsenate family. Dissert. Abstr.

N78-16894 Case Western Reserve Univ., Cleveland, Ohio.
CALCULATION OF OPTICAL AND X-RAY K-ABSORPTION SPECTRA OF ALUMINUM Ph.D. Thesis
Frank Szmulowicz 1977 176 p
Avail: Univ. Microfilms Order No. 77-25197

While the energy bands were in moderately good agreement with optical data, they were not as accurate as desired when compared with the experimental uncertainty. To improve the accuracy of the calculation the semi-empirical scheme of Chen and Segall was used to adjust the band structure. To implement this improvement, a few pieces of experimental data on dHvA cross sections, the position of a major optical peak, and the bandwidth of Al were used. Using the parameterized bands and wave functions, an RPA calculation was made for the dielectric constant of Al in which the dipole transition matrix elements were fully included. An aspect of this work was the careful elucidation of the small frequency behavior of the imaginary part of the interband dielectric constant of Al, which was shown both numerically and analytically to go to a nonzero constant at zero frequency as a result of an accidental degeneracy of two bands on the PKWX plane. Dissert. Abstr.

N78-16895 Rutgers - The State Univ., New Brunswick, N. J.
ROTATIONAL INVARIANCE AND MAGNETOELASTIC PHENOMENA IN PARAMAGNETS Ph.D. Thesis
Ping-Shih Wave 1977 137 p
Avail: Univ. Microfilms Order No. 77-25026

The results of experimental studies of the rotational magnetoelastic effect are presented. This effect arises from the antisymmetric part of the strain tensor, which was usually thought to be of little importance in the distortion of a solid. Measurements were made of the sound velocity in solids at high field and low temperatures. The field dependent sound velocity changes differently for different directions of magnetic field relative to the sound propagation direction. Without any adjustable parameters, the experimental results agree surpisingly well with the theoretical predictions for the C44 mode of TmSb. The inclusion of higher order magnetoelastic interactions is discussed.
Dissert. Abstr.

N78-16896 Syracuse Univ., N. Y.
SPIN DEPENDENCE OF TIME-RESOLVED INTERIMPURITY LUMINESCENCE SPECTRA IN SILICON AT LIQUID HELIUM TEMPERATURES AND HIGH MAGNETIC FIELDS Ph.D. Thesis
Peter Eugene Vanier 1976 153 p
Avail: Univ. Microfilms Order No. 77-24417

The luminescence associated with donor-acceptor electron transfer is studied at high magnetic fields and low temperatures. Under these conditions, the carriers are highly polarized and the radiative transitions are partially forbidden. Changes in transition rates are deduced from the time scales of the decay of the luminscence using a new method of matching spectra taken at different delay times after excitation of the sample, and different states of polarization. Analysis of the change of transition rate as a function of H/T yields hole g-values for each of four shallow acceptors, and shows that there is an anisotropic splitting factor (probably due to local strains) which is correlated with the size of the acceptor atom. This method of detection yields information about the rates of spin-lattice relaxation of donor electrons as a function of their separation from the nearest neutral acceptor.
Dissert. Abstr.

N78-16897 Case Western Reserve Univ., Cleveland, Ohio.
THE INTRINSIC STRESS AND MICROSTRUCTURE OF ZnS AND TiO SUB x THIN FILMS Ph.D. Thesis
Robert Paul Wenz 1977 94 p
Avail: Univ. Microfilms Order No. 77-25204

The intrinsic stress and microstructure of vacuum deposited TiO(x) thin films were studied as a function of oxygen partial pressure and substrate temperature (Ts). Auger electron spectroscopy combined with Rutherford backscattering spectroscopy provided quantiative depth profiles of composition. Transmission electron microscopy and selected area diffraction allowed structural characterization. Two temperature regions of differing stress and microstructural character were apparent. For Ts < 150 C the films are amorphous and both the stress and composition ratio were independent of film thickness.
Dissert. Abstr.

N78-16898 Catholic Univ. of America, Washington, D. C.
AN INVESTIGATION OF NON-EQUILIBRIUM PROCESSES IN A BULK SUPERCONDUCTOR VERY NEAR T SUB c Ph.D. Thesis
Michael Calvin Wilt 1977 186 p
Avail: Univ. Microfilms Order No. 77-24488

The first method for studying non-equilibrium effects in bulk superconductors near T sub c is reported and the determination by this method of an effective relaxation time tau in bulk superconducting indium is outlined. This method makes possible the first definite confirmation of the predicted delta-1 divergence of the order parameter relaxation time near T sub c. The method involves the rapid oscillatory displacement near T sub c of normal-superconducting (N-S) interfaces associated with the alternating N and S laminas of the intermediate state. It was established that the method developed has a peculiar suitability for studying non-equilibrium phenomena near T sub c in bulk superconductors. Dissert. Abstr.

N78-16899 Ohio Univ., Athens.
MEASUREMENT OF MAGNETIC FLUX PINNING NEAR THE SURFACE IN PROTON-IRRADIATED THICK Nb SAMPLES Ph.D. Thesis
Anjaneyulu Yellapu 1977 203 p
Avail: Univ. Microfilms Order No. 77-23478

Very pure annealed cylindrical Nb samples were irradiated with protons in the 3-8 Mev energy range. The annealed samples were characterized before irradiation by resistivity ratio, magnetization, Tc, Hc1, Hc2 and pre-irradiation field profile measurements. The resistivity ratio of the annealed samples ranged from 1300 to 1700. The magnetization curves of the annealed samples showed practically no hysteresis. It was found that Tc = 9.289 + or - 0.01K and Hc2 (4.2K) = 2.71 + or - 0.03 KOe. Tc, Hc1, and Hc2 measured values were in agreement with previous values reported for very pure Nb. Samples having practically no pinning were selected for proton bombardment. The critical current density at 4.2K of the annealed samples ranged from about 200 amp/cm squared at b = B/Bc2 = 0.5 to about 25 amp/cm squared at b = 0.9. Magnetic field profiles were obtained using the ac technique of Rollins, Kuper and Gey. Field profile measurements of the irradiated samples for magnetic fields lying between Hc1 and Hc2 showed a drastic increase in magnetic flux pinning at a depth close to the range of protons. Field profile measurements for temperatures between 2K and 7K showed flux pinning increasing as the temperature was lowered. Dissert. Abstr.

N78-16900 Texas Univ., Austin.
CRYSTAL CHEMICAL INVESTIGATIONS: ELECTRICAL MEASUREMENTS AND MOESSBAUER SPECTROSCOPY OF SELECTED PHASES IN THE Ba-Fe-S SYSTEM

Ph.D. Thesis
Luis Emilio Rendon Diaz Miron 1977 90 p
Avail: Univ. Microfilms Order No. 77-23022

The room temperature Mossbauer spectrum of Ba9Fe4S11 (S)2(S3) shows isomer shifts of 0.2 mm/sec and 0.4 mm/sec for the two crystallographically different irons. These values are in good agreement with the +3 and +2.5 oxidation states that iron must have for electrical neutrality in this compound, where the charge of +2.5 is obtained when electron delocalization between two near neighbor divalent iron atoms occurs. Ba4Fe-2S6S2/3(S2)1/3 shows a Mossbauer isomer shift of 0.18 mm/sec, a value indicating Fe(+3) in agreement with stoichiometry. The Mossbauer spectrums of Ba3(Fe sub 1-x Si sub x)S5 show an isomer shift value of 0.15 mm/sec for all values of x investigated, but different values of quadrupole splittings. All compounds show high resistivity values, of the order of 100,000 ohm-cm at room temperature. Dissert. Abstr.

N78-16901 Stevens Inst. of Tech., Hoboken, N. J.
NUCLEAR MAGNETIC RESONANCE OF ADSORBED HELIUM-3 FILMS Ph.D. Thesis
Suryanarayan Ganesh Hegde 1977 229 p
Avail: Univ. Microfilms Order No. 77-26935

Nuclear magnetic resonance (NMR) linewidth measurements were made at 5.5 MHz for fractional coverages of a He3 on Grafoil and argon coated Grafoil between x = 0.20 and x = 1.35, in the temperature range of 0.35K to 4.21K. Results indicate that low coverage (x less than 0.5) are highly mobile and behave as two dimensional non-ideal Fermi gases. Relative magnetic susceptibilities determined from the NMR lines indicate that the onset of Fermi degeneracy is delayed by spin-independent He3-He3 interactions. The near-monolayer coverages (0.9 less than x 1.0), on the other hand, behave as solids with dipole coupling modulated by quantum exchange between nearest neighbours. A sharp decrease observed in linewidth after the completion of the monolayer makes NMR an excellent probe for determining monolayer completion. Dissert. Abstr.

N78-16902 Louisiana State Univ. and A&M Coll., Baton Rouge.
FAR INFRARED DETECTION WITH JOSEPHSON JUNCTIONS Ph.D. Thesis
Chi Kong So 1977 100 p
Avail: Univ. Microfilms Order No. 77-25404

The response of Josephson junctions to microwave and far infrared radiation was studied. Junctions were formed by pressing a Nb-Ti pointed wire onto a Nb or Nb-Ti pointed wire onto a Nb thin film which in turn was pressed against the open end of a waveguide. Electromagnetic radiation was applied through the back of the films so that only the wave magnetic field was coupled to the junction. The change of the d.c. Josephson current was monitored at different levels of microwave power over a frequency range from 22GHz to 105GHz. The dependence of the responsivity of these currents on film thickness over a range from 50A to 500A was studied. The observed responsivity agrees very well with that predicted by theory. Higher responsivity was observed for thinner films and lower microwave frequencies. Dissert. Abstr.

N78-16903 Stanford Univ., Calif.
CAPACITANCE MEASUREMENT TECHNIQUES APPLIED TO THE STUDY OF DEEP LEVELS IN GALLIUM ARSENIDE Ph.D. Thesis
Prahalad K. Vasudev 1977 162 p
Avail: Univ. Microfilms Order No. 77-25739

Photocapacitance, transient capacitance, electrical injection and minority carrier trapping transient techniques were applied to the detection and characterization of: residual impurities in high purity liquid phse epitaxial GaAs, and chromium, oxygen and other related levels in bulk grown GaAs that was purposely doped with chromium or oxygen. Dissert. Abstr.

N78-16904# National Bureau of Standards, Washington, D. C.
STANDARD X-RAY DIFFRACTION POWDER PATTERNS. SECTION 14: DATA FOR 68 SUBSTANCES Interim Report
M. C. Morris, H. F. McMurdie, E. H. Evans, B. Paretzkin, and J. H. DeGroot Sep. 1977 147 p
(PB-272372/4; NBS-Mono-25-Sect-14) Avail: NTIS HC A07/MF A01 CSCL 20B

Twenty-seven patterns represent experimental data and 41 are calculated. The experimental X-ray powder diffraction patterns were obtained with an X-ray diffractometer. All d-values were assigned Miller indices determined by comparison with computed interplanar spacings consistent with space group extinctions. The densities and lattice constants were calculated, and the refractive indices were measured whenever possible. The calculated X-ray powder diffraction patterns were computed from published crystal structure data. Both peak height and integrated intensities are reported for the calculated patterns. GRA

N78-16905# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
INVESTIGATION OF TECHNOLOGICAL PROBLEMS IN GaAs Final Report, 18 Dec. 1974 - 31 Dec. 1976
R. Zucca, F. Eisen, A. Higgins, A. A. Immorlica, C. P. Wen, D. R. Chen, W. Hill, B. W. Ludington, G. D. Robinson, and B. M. Welch Griffiss AFB, N. Y. RADC 24 Feb. 1977 306 p refs (Contract F19628-75-C-0113; ARPA Order 2489)
(AD-A047312; SC5017.17FR; RADC-TR-77-136) Avail: NTIS HC A14/MF A01 CSCL 20/12

This report presents the results of an investigation of technological problems associated with the growth and preparation of GaAs with emphasis on problems related to microwave devices. One of the most significant accomplishments of this program is the high uniformity and reproducibility of doping profiles achieved by ion implantation into semi-insulating substrates. Such results have brought GaAs ion implantation into maturity as a technique for preparation of device quality layers. These results are not only expected to lead to increased use of ion implantation for discrete FET device fabrication, but also to pave the way for the development of a planar GaAs IC technology. Experimental measurements of the low frequency noise of IMPATT diodes have been used to extract parameters useful for device design, such as intrinsic response time and multiplication factors under operating conditions. Measurements of ionization rates as functions of the electric field showed a strong dependence on doping concentration which has been qualitatively interpreted in terms of delays in promotion of the accelerated electrons into the higher conduction bands. GRA

N78-16906# Sandia Labs., Albuquerque, N. Mex.
SOME APPLICATIONS OF HIGH PRESSURE STUDIES OF PHASE TRANSISTIONS IN SOLIDS
G. A. Samara 1977 35 p Presented at 6th AIRAPT Intern. High-Pressure Conf., Boulder, Colo., 25 Jul. 1977
(Contract EY-76-C-04-0789)
(SAND-77-0104; Conf-770706-13) Avail: NTIS HC A03/MF A01

A review is presented of the most unique applications of pressure-induced phase transitions in solids, namely that of shock-wave-actuated pulse power devices employing either ferromagnetic or ferroelectric materials. The principles of operation of these devices are reviewed and some of the associated materials properties and phase transitions are discussed. ERA

N78-16907# California Univ., Livermore. Lawrence Livermore Lab.
THEORETICAL STUDIES OF SOLITON-LIKE BEHAVIOR OF SHOCKS IN ONE-DIMENSIONAL SYSTEMS
J. R. Hardy and A. M. Karo 18 Jul. 1977 16 p refs Presented at the Intern. Conf. on Lattice Dynamics, Paris, 5 Sep. 1977
(Contract W-7405-eng-48)
(UCRL-79259; Conf-770913-1) Avail: NTIS HC A02/MF A01

Results are presented of numerical studies on shocks propagation in one dimensional lattices. Shocks were launched into these systems by both pulse and impact loading. The studies show that pulse-generated shocks are highly stable, and spall atoms off the free ends of such lattices. They also can collide, pass through one another, and emerge unchanged. Impact loading generates multiple shocks and leads to multiple spall. The nature of this spall depends on the assumed interatomic potential. If this potential is such that the lattice is metastable, then the initial spall leads to extensive further spall which finally disrupts the lattice. ERA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N78-16908*# Adelphi Univ., Garden City, N. Y. Center for Energy Studies.
ADELPHI-GODDARD EMULSIFIED FUEL PROJECT
7 Oct. 1977 84 p refs Submitted for publication
(Contract NAS5-23688)
(NASA-CR-156683) Avail: NTIS HC A05/MF A01 CSCL 20M

Thermal efficiency and particle emissions were studied using water/oil emulsions. These studies were done using number 2 and number 6 fuel oil. The number 6 oil had a sulfur content greater than one percent and experiments were conducted to remove the sulfur dioxide from the stack gases. Test findings include: (1) emulsion effected a reduction in soot at a low excess air levels; (2) a steam atomizing system will produce a water/oil emulsion. The fuel in the study was emulsified in the steam atomization process, hence, pre-emulsification did not yield a dramatic reduction in soot or an increase in thermal efficiency. J.C.S.

N78-16909# Arizona Univ., Tucson. Engineering Experiment Station.
CONVECTION IN THE CLOSED BRAYTON CYCLE Annual Summary Report, 1 Apr. 1976 - 31 Mar. 1977
P. E. Picket and D. M. McEligot 1 Apr. 1977 75 p refs
(Contract N00014-75-C-0694; NR Proj. 097-395)
(AD-A047262; Rept-1248-5; ASR-3) Avail: NTIS HC A04/MF A01 CSCL 20/13

To correspond to conditions expected in components in the closed Brayton cycle, analyses and experiments were conducted for forced convective heat transfer to gases and gas mixtures flowing in ducts. The range of interest was 0. Numerical analyses predicted that existing scaling laws for gases would not represent the Prandtl number dependence adequately for laminar or turbulent flow. Measurements with an argon-helium mixture confirmed the trends of the predictions for turbulent flow in circular tubes. The wall turbulent Prandtl was determined for $0.4 < \text{or} = Pr < \text{or} = 0.5$. GRA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N78-16910 California Univ., Los Angeles.
TECHNICAL RISK MANAGEMENT IN ADVANCED TECHNOLOGY DEVELOPMENT Ph.D. Thesis
James C. Riple, Jr. 1977 345 p
Avail: Univ. Microfilms Order No. 77-23917

Technical risk management was defined as the presence of significant technical uncertainty at the begining of a technology development program. This uncertainty is manifested in a risk of wasting the resources invested in the program. The invested resources must be managed in their relationship to technical uncertainty in order to limit the program risk to an acceptable level. This investigation covers as a series of personal interviews with a number of technical leaders in the advanced technology development field. Other data were developed by recasting and integrating data from the engineering, systems, management and behavioral sciences literature. Dissert. Abstr.

N78-16911 Ohio State Univ., Columbus.
COMPUTER OPERATING SYSTEM FACILITIES FOR THE AUTOMATIC CONTROL AND ACTIVITY SCHEDULING OF COMPUTER-BASED MANAGEMENT SYSTEMS Ph.D. Thesis
Dov Isaacs 1977 254 p
Avail: Univ. Microfilms Order No. 77-24643

The role of computer operating systems was extended from job supervision into the realm of automatic control and activity scheduling of computer-based management systems. Primary emphasis was placed on the functional specification of a model for a computer operating system with the capability of automatic control and activity scheduling of computer-based management systems. The technology of the traditional job processing operating system was extended to provide operating system services directly at the integrated application system level as well as at the existing component job level. Dissert. Abstr.

N78-16912 Rochester Univ., N. Y.
THE EFFECTS OF NOMINAL AND BRAINSTORMING DECISION-MAKING PROCEDURES ON GROUP PRODUCTIVITY Ph.D. Thesis
Larry Dean Eldridge 1977 145 p
Avail: Univ. Microfilms Order No. 77-16221

Group decision-making and productivity are investigated together; studying the impact of various decision-making procedures on the total process, from the formulation of the problem to the implementation of the final solution. Forty-nine 4-person groups of undergraduate volunteers followed three different decision-making procedures to arrive at a solution to the Lego Block Tower task and then implemented their solution. Both commitment to carry out the decision and decision quality were found to be associated with productivity. Productivity was predicted significantly better by an additive regression model using commitment and decision quality as the predictors than by a multiplicative model using the product of commitment and decision quality as the predictor. Dissert. Abstr.

N78-16913# Michigan Univ., Ann Arbor. Inst. for Social Research.
COMPARATIVE ISSUES AND METHODS IN ORGANIZATIONAL DIAGNOSIS
David G. Bowers, Alan S. Davenport, and Gloria E. Wheeler
Nov. 1977 93 p refs
(Contract N00014-77-C-0096)
(AD-A047292) Avail: NTIS HC A05/MF A01 CSCL 05/1

This report both introduces the topic of research on organizational diagnosis and discusses the methodological issues involved in it. It then describes the analyses to be reported in subsequent technical reports in the series. Four methods of diagnostic classification are to be examined using the Survey of Organizations data bank: distance function, multiple discriminant function, Bayesian, and decision tree. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N78-16914 Washington Univ., Seattle.
OPTIMUM ORDERED HASH TABLES Ph.D. Thesis
Glenn Nichols Thomas 1977 248 p
Avail: Univ. Microfilms Order No. 77-26870

Information storage and retrieval is the problem of storing records of information in a manner that allows for later retrieval and use of these records. When files of information are maintained

within computer systems, two widely accepted approaches to this problem are hashing and sequential ordering. Neither of these approaches has been implemented in a manner that recognizes the fact that different records will be retrieved with different frequencies depending on their relative importance. Weighted Bidirectional Linear Probing (WBLP) is a hashing method that provides several benefits to the users of information. First, the records are sequentially ordered on the storage device. Thus, changes to the records may be efficiently processed by merging the file as stored with an ordered list of the records to be changed. Second, WBLP explicitly recognizes differences in the relative importance of records by assuring that the more important records are more easily accessed. Dissert. Abstr.

N78-16915# City Univ., London (England). Center for Information Science.

LINGUISTIC AND COGNITIVE MODELS OF INFORMATION AND STATE OF KNOWLEDGE Final Report, 21 Sep. - 20 Oct. 1976

Nicholas J. Belkin Aug. 1977 51 p refs

(BLL-BLRDR-5381-(2113.56F)) Avail: British Library Lending Div., Boston Spa, Engl.

A number of cognitive models representing information systems and state of the art were surveyed. Various secondary services of information systems were considred, as well as automated retrieval systems. J.A.M.

N78-16916# Naval Postgraduate School, Monterey, Calif.

NAVY TACTICAL DATA INFORMATION DISPLAY COMPLEXITY EFFECTS ON VISUAL SEARCH REACTION TIME AND RESPONSE ACCURACY M.S. Thesis

Lawrence Edward Curran Sep. 1977 52 p refs

(AD-A047135) Avail: NTIS HC A04/MF A01 CSCL 05/2

The purpose of the experiment was to evaluate pre-defined display formatting from the standpoint of response accuracy and reaction time for use with a tactical information display for the U.S. Navy. Subjects were required to retain a single consonant probe in short term memory while searching one of six pre-formatted displays for a target label. Upon detecting the target a keyboard entry was made reflecting the data associated with that target label. The subject was then presented with a two or four letter set from which he was to indicate the presence or absence of the memory probe. Reaction time increased and response accuracy decreased to a highly correlated and statistically significant level as the number of elements in the display screen increased. The secondary memory probe task was not found to have a statistically significant effect on the search reaction time among the 24 subjects who participated in the experiment. Author (GRA)

N78-16917# Stanford Univ., Calif. Dept. of Engineering-Economic Systems.

INFORMATION PERISHING AND REPLENISHMENT Ph.D. Thesis

Allen Frederick Grum Oct. 1977 123 p refs

(Grant NSF GK-36491)

(AD-A046911; EES-DA-77-1) Avail: NTIS HC A06/MF A01 CSCL 12/1

This dissertation treats the dynamics of a decision maker's value of information. A notion, widely held by decision analysts but tenuously defined, is that the value of any specific information diminishes over time. This concept, termed information perishing, is rigorously defined and illustrated by the use of a Markov model. The main assertions of the first section are: (1) Information perishing is inevitable (not only for the Markov model of information but for any state of information described by a probability distribution); (2) For the Markov model the absolute value of the largest transient eigenvalue is an upper bound for the rate of information perishing; and (3) The rate of perishing is a decreasing function of time. A second model of the decision process recognizes that many decisions in real life are 'triggered' by events which may be described by some stochastic process. Without this uncertainty the decision maker could simply discount the value of information because of perishing and would reduce his problem to a static case; however, the uncertainty in timing forces consideration of optimal policies of information replenishment. Rules of optimality are developed for singly and multiple occurring decisions. GRA

N78-16918# Stanford Research Inst., Menlo Park, Calif. Network Information Center.

ARPANET DIRECTORY

Jul. 1977 208 p refs

(Contract DCA200-77-C-0641)

(AD-A046948; AD-E100002; NIC-41472) Avail: NTIS HC A10/MF A01 CSCL 09/2

This report is a directory of users and hosts on the ARPANET. It gives the names, network and U.S. Mail addresses, phone number, and host affiliation of ARPANET users, as well as summary tables of host information. Author (GRA)

N78-16919# Center for Naval Analyses, Arlington, Va.

A BIBLIOMETRIC EXAMINATION OF THE SQUARE ROOT THEORY OF SCIENTIFIC PUBLICATION PRODUCTIVITY

Russell C. Coile Oct. 1977 11 p refs Presented at the Ann. Meeting of the Am. Soc. for Inform. Sci., Chicago, 29 Sep. 1977

(AD-A047237; CNA-Professional-Paper-20) Avail: NTIS HC A02/MF A01 CSCL 07/4

A postulated model of scientific productivity asserts that half of all scientific papers in a field are contributed by a few highly productive authors numbering approximately the square root of the total of scientific authors. Available data has been examined to judge the validity of the theoretical model on the basis of empirical evidence. Additional data concerning the scientific productivity of physicists, mathematicians, biologists, computer scientists, econometricians, operations researchers, and entomologists suggests that the most productive square root of the total authors produced an average of 25 percent of the total papers. These data bases had scores between 9 percent and 38 percent with one exception - a 57 percent recorded for a university physics department. GRA

N78-16920# Benson and Benson, Inc., Princeton, N. J.

SURVEY OF NATIONWIDE ON-LINE ACCESS TO EVALUATED ENGINEERING DESIGN DATA. STUDY 2: SURVEYS OF CHIEF ENGINEERS AND DESIGN ENGINEERS Interim Report

Jun. 1977 43 p Prepared for Eng. Index, Inc., New York

(Grant NSF DSI-76-16654)

(PB-272938/2) Avail: NTIS HC A03/MF A01 CSCL 05B

A study was conducted to determine which, if any, information products and services, including on-line interactive access, data collections would be accepted on a sustainable basis by the engineering community. The results are presented of mail questionnaires administered to two groups of practicing engineers: (1) chief engineers, to obtain an overall view of departmental engineering needs and practices; (2) design engineers, to delineate the needs and practices of the individual. Results are evaluated, summarized, and conclusions presented. GRA

N78-16921# George Washington Univ. Medical Center, Washington, D.C. Science Communication Div.

PRELIMINARY REPORT OF THE POLICYMAKERS' PERSPECTIVE 3RD CONFERENCE OF THE NATIONAL FORUM ON SCIENTIFIC AND TECHNICAL COMMUNICATION

Jun. 1977 40 p Conf. held at Washington, D. C., 2 Jun. 1977

(Contract NSF C-743)

(PB-272988/7; GWU-SCD-77/3) Avail: NTIS HC A03/MF A01 CSCL 05B

The third Conference of the National Forum on Scientific and Technical Communication, the Policymakers' Perspective Conference, addressed the question, Are there current needs for public policies affecting scientific and technical communication in the United States and if so, what are the options. Policymakers and their staffs, experts in scientific and technical communication, and decisionmakers from all sectors came together to discuss their viewpoints and perceptions about the problems and issues related to scientific and technical information. The workshop discussions at the Conference focused upon the four issue areas emphasized at the previous Users' Perspective Conference and the Providers' Perspective Conference. This report presents the issues raised by the participants at the Policymakers' Perspective Conference. GRA

N78-16922# Cranfield Inst. of Technology (England).
THE BENEFICIAL LIBRARY: A METHODOLOGICAL INVESTIGATION TO IDENTIFY WAYS OF MEASURING THE BENEFITS PROVIDED BY LIBRARIES
Gordon Wills and Christine Oldman Jul. 1977 267 p refs
(BLL-BLRDR-5389-(2113.56F)) Avail: NTIS Avail: British Library Lending Div., Boston Spa, Engl.

User requirements were examined in an effort to develop effective resource management methods for libraries and information services. Methods were derived and identified for measuring the differences between users' expectations of a library system and their experiences when using the system. Explanations of use and nonuse are given. J.M.S.

N78-16923# University Coll., London (England). Dept. of Statistics and Computer Science.
THE INDRA NETWORK MEASUREMENT PROJECT
Adrian Stokes 1 Jun. 1977 93 p refs
(Contracts N00014-74-C-0240; N00014-77-B-0005)
(BLL-BLRDR-5411(2113.56F); INDRA-TR-30) Avail: British Library Lending Div., Boston Spa, Engl.

A definitive guide to the user level of network measurement is presented. The aims of the project, concepts behind the various programs and implementation, and results are described. Author

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N78-16924# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1979, PROGRAM REVIEW, VOLUME 1, PART 1
Washington GPO 1977 1286 p refs Comm. on Sci. and Technol., 95th Congr., 1st Sess., No. 30, 4-6 Oct. 1977
(GPO-99-249) Avail: Subcomm. on Space Sci. and Applications

NASA programs are reviewed in testimony delivered and materials submitted to justify funding requests. The workshop report on the effects of chlorofluoromethanes on stratospheric ozone is included. A.R.H.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N78-16925 Colorado Univ., Boulder.
PROCESS MODIFICATIONS OF AEROBIC DIGESTION FOR PRODUCT STABILITY AND NITROGEN CONTROL Ph.D. Thesis
Roger Barton Hartman 1977 223 p
Avail: Univ. Microfilms Order No. 77-24227

Both elutriation and biological denitrification were investigated in a study of the effectiveness of the aerobic digestion process in controlling odor and ground water contamination by nitrates prior to the land application of sludge. Additional alkilinity was generated by inserting a biological denitrification reactor into the sequence of the aerobic digestion process. The added buffering capacity resulted in the stimulation of additional nitrification during subsequent aerobic digestion. The denitrification process was also effective in reducing the nitrogen content of the product sludge. Dissert. Abstr.

N78-16926 Texas Univ., Austin.
TEMPERATURE EFFECTS ON THE ACTIVATED SLUDGE PROCESS Ph.D. Thesis
Basim Aziz Sayigh 1977 196 p
Avail. Univ. Microfilms Order No. 77-23030

The effects of temperature variations on the kinetics and the performance efficiency of the completely mixed continuous flow activated sludge process were studied while treating domestic wastewater, an organic chemicals industrial wastewater, and the mixed industrial wastewater resulting from several industries. The kinetic coefficients governing cell-synthesis, microorganism decay, soluble substrate utilization, and dissolved oxygen utilization were evaluated at the different temperatures. The efficiency of soluble substrate removal and the settling characteristics of the micro organisms in the mixed liquor were also determined.
Dissert. Abstr.

N78-16927 Missouri Univ., Rolla.
AEROBIC DIGESTION OF SEWAGE LIME SLUDGE Ph.D. Thesis
Kuo-Chun Tsai 1977 263 p
Avail: Univ. Microfilms Order No. 77-23686

A research study was undertaken in the laboratory with a primary objective to establish design and operational criteria for aerobic digestion of sewage lime sludge generated from phosphorus precipitation in the primary clarifier. Both batch and semi-continuous-flow reactors were used, and experimental tests were carried out at three temperatures: 10, 20 and 30 C. Special emphasis of the study was placed on the evaluation of various parameters pertinent to the optimal process design and operational control of such a digester system. These include: detention time, oxygen uptake rate, VSS destruction, liquid sludge COD reduction, supernatant COD and phosphorus contents, sludge settleability and dewaterability, and potential phosphorus release.
Dissert. Abstr.

N78-16928*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BASELINE TESTS OF THE C. H. WATERMAN RENAULT 5 ELECTRIC PASSENGER VEHICLE
Noel B. Sargent, Edward F. McBrien, and Ralph Slavik Oct. 1977 58 p refs
(Contract EC-77-A-31-1011)
(NASA-TM-73759; E-9434; CONS/1011-4) Avail: NTIS HC A04/MF A01 CSCL 13F

The Waterman vehicle, a four passenger Renault 5 GTL, performance test results are presented and characterized the state-of-the-art of electric vehicles. It was powered by sixteen 6-volt traction batteries through a two-step contactor controller actuated by a foot throttle to change the voltage applied to the 6.7 -kilowatt motor. The motor output shaft was connected to a front-wheel-drive transaxle that contains a four-speed manual transmission and clutch. The braking system was a conventional hydraulic braking system. Author

N78-16929# Transportation Research Board, Washington, D. C.
TRANSPORTATION SYSTEM MANAGEMENT
1977 171 p Conf. held at Minneapolis, 7-10 Nov. 1976 Sponsored in part by UMTA, Wash. D. C., FHA, Wash. D.C. and Institute of Trans. Eng., Arlington, Va.
(PB-272846/7; TRB/SR-172) Avail: NTIS HC A08/MF A01 CSCL 13B

The following topics are discussed: Traffic operations improvements to manage and control the flow of vehicles; Preferential treatment for transit and other high occupancy vehicles; Management and control of parking; Actions to reduce vehicle use; Actions to improve transit management efficiency; Transportation system management from the Federal Highway

Administration perspective; State Highway Department view of TSM; Management by objectives applied to transportation system management; Packaging transportation elements to meet energy goals; Packaging transportation elements to meet environmental objectives. GRA

N78-16930# District of Columbia Dept. of Environmental Services, Washington, D.C. EPA-DC Pilot Plant.
ALUM ADDITION AND STEP-FEED STUDIES IN OXYGEN-ACTIVATED SLUDGE Final Report, Oct. 1972 - Oct. 1973
Dolloff F. Bishop, James A. Heidman, Richard C. Brenner, and John B. Stamberg Sep. 1977 43 p refs
(Contract EPA-68-01-0162)
(PB-272892/1; EPA-600/2-77-166) Avail: NTIS HC A03/MF A01 CSCL 13B

A plug flow, O2-activated sludge process was operated with alum addition to remove phosphorus and with lime addition to prevent the process pH from decreasing below 6.4. The pollutant removals from the primary effluent ranged from 82 to 92% for BOD5 and from 54 to 86% for phosphorus. The optimum P removal occurred at a 1.8 to 1 average Al/P mole ratio with an average total residual P of 1.05 mg/l. In a second study, the O2 process was operated in a step-feed configuration consisting of a sludge oxygenation stage followed by three stages of oxygen aeration with equal portions of the primary effluent fed to each stage. In typical operation, the process with a F/M ratio of 0.23 exhibited a MLSS concentration profile in the four stages of 10,700 mg/l; 7,060 mg/l; 5,020 mg/l; and 4,150 mg/l. The step configuration clearly reduced the solids loading to the clarifier and provided an average MLSS of more than 6,500 mg/l. The step operation produced excellent BOD5 removals (89% from primary). The O2 usage in the step configuration was significantly less than the 90% typically achieved in co-current contacting. GRA

N78-16931# Resource Planning Associates, Inc., Washington, D. C.
EUROPEAN WASTE-TO-ENERGY SYSTEMS. AN OVERVIEW
Jun. 1977 62 p Prepared in cooperation with Resource Planning Associates, Inc., Paris (France)
(Contract EX-76-C-01-2103)
(CONS/2103-6) Avail: NTIS HC A04/MF A01

The recovery of energy through the combustion of municipal solid wastes is a well-established technique for conserving energy. Combustion units can produce electricity; hot water for domestic use; and steam for district heating, industrial processes, or the drying of sewage sludge. There are fewer than 20 such waste-to-energy systems in the United States. In Western Europe, however, 243 combustion units are currently recovering energy from municipal solid wastes. The oldest of these facilities went into service before World War II. Some key facts about Western Eurpoean countries and their waste-to-energy units are presented. The items discussed include: some common features of the Western European systems; the combustion techniques available; the end uses to which the recovered energy is put; and the econmics of the systems. A tabulation of the systems currently operating or under construction in Western Europe is included. ERA

N78-16932# Resource Planning Associates, Inc., Washington, D. C.
EUROPEAN WASTE-TO-ENERGY SYSTEMS: CASE STUDY OF THE THERMAL COMPLEX OF TOULOUSE-LE MIRAIL (FRANCE)
May 1977 45 p refs Prepared in cooperation with Resource Planning Associates, Paris (France).
(Contract EC-77-C-01-2103)
(CONS/2103-1) Avail: NTIS HC A03/MF A01

The waste treatment system of Toulouse-Le Mirail (France) is a complex composed of an incinerator with heat-recovery equipment and an oil-fired heating facility. It was designed to burn the household waste of a city of 400,000 inhabitants while at the same time providing central heating and hot water to a suburb of 100,000 inhabitants. Sufficient electricity is also generated for in-plant use. Technical data for the system are reported in detail. The economics and management were reviewed. The system has operated for five years without major problems. Author (ERA)

N78-16933# Resource Planning Associates, Inc., Washington, D. C.
EUROPEAN WASTE-TO-ENERGY SYSTEMS: CASE STUDY OF MUNICH: MUNICH NORTH IA AND IB, MUNICH NORTH II, MUNICH SOUTH IV AND V
May 1977 92 p refs
(Contract EX-76-C-01-2103)
(CONS/2103-4) Avail: NTIS HC A05/MF A01

The city of Munich has a population of 1,315,000. Solid waste is collected by a city department and delivered to the city's own Electricity Works. The Electricity Works incinerate the waste in five incinerators in two separate locations (the North and South plants). Munich's five incinerators represent three different designs for co-generation of heat and electrical energy. All burn both waste and fossil fuel and all use Benson boilers to produce steam at 184 bars and 540 C. The Electricity Works recovers energy in the form of electricity, hot water, and steam. The system is peakloaded both for electricity and for district heating, and as a result, is operated with some diseconomy. Over 450,000 metric tons of waste were burned in 1975. That amount represents practically all the solid waste collected in Munich. The rates charged appear to be far below actual costs of incineration, which suggests that the sale of electricity is subsidizing the cost of incineration. ERA

N78-16934# Resource Planning Associates, Inc., Washington, D. C.
EUROPEAN WASTE-TO-ENERGY SYSTEMS: CASE STUDY OF KOERSOR, DENMARK
May 1977 37 p
(Contract EX-76-C-01-2103)
(CONS/2103-3) Avail: NTIS HC A03/MF A01

Koersor, Denmark operates a waste-to-energy system for only 20,000 persons. Energy is recovered in the form of heat for district heating and the facility has been operating reliably for about four years. The apparent success of this installation suggests that the system may have applications in smaller communities. The design and operation of the facility is sumarized. The energy recovered from the boiler amounts to about 7, kilotherms per year. The thermal efficiency of the plant is estimated at approximately 50 percent. Taking into account energy which is lost because it cannot be sold, the overall efficiency decreases to approximately 30 percent. The total cost of the complex was 7,000,000 Kr ($944,700; 1971 or $1.437,600; 1976) with 4,600,000 of that sum going for the incinerator. The overall cost of incineration is estimated today at 120 Kr per metric ton including both capital and operating cost, after making provision for the value of heat recovered. ERA

N78-16935# Resource Planning Associates, Inc., Washington, D. C.
EUROPEAN WASTE-TO-ENERGY SYSTEMS: CASE STUDY OF GENEVA-CHENEVIERS (SWITZERLAND)
May 1977 41 p refs
(Contract EX-76-C-01-2103)
(CONS/2103-2) Avail: NTIS HC A03/MF A01

The City of Geneva, population 159,000 is the administrative center of the Canton of Geneva, population 340,000. The Canton owns a number of facilities for the treatment of waste. Geneva's chief waste treatment facility is the Cheneviers Incinerator. Two outdated Von Roll integrated boiler incinerator furnaces have a rated capacity of 200 metric tons per day each. Superheated steam 360 C and 32.4 bars powers a 6200 kW turbo-generator unit. The electricity is sold to the cantonal grid. Total incinerable waste in the Canton of Geneva has varied from 120,000 to 130,000 metric tons annually during the last five years. For the last two years, total per capita tonnage has been declining. The remainder was landfilled, due to the lack of capacity at the incinerators. The system which began operating in 1966, cost approximately 40 million Swiss Francs. Three-quarters of this sum was for land, buildings, construction, and equipment. A large station and dock for the transfer of waste accounted for the remainder. ERA

N78-16936# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COSTS AND ENERGY EFFICIENCY OF A DUAL-MODE SYSTEM
R. C. Heft and C. S. Borden 30 Apr. 1977 76 p refs
(Contract DOT-AT-60008)
(PB-272714/7; UMTA-CA-06-0088-77-2) Avail: NTIS HC A05/MF A01 CSCL 13B

A more detailed examination is given of two areas of a previous analysis on a Dual-Mode System. The technical and cost data of the previous report and its life-cycle cost approach are used. This report consists of two parts plus the Appendices: (1) an economic analysis, and (2) an energy consumption analysis. The economic analysis examines the present value life-cycle costs of the system for both public and semi-private ownership and presents the costs in terms of levelized required revenue per passenger mile. Two transit modes associated with a high-speed guideway system are included (pallets and command actuated passenger service (CAPS) vehicles). The energy consumption analysis considers the energy use of the various dual-mode vehicles by means of a detailed vehicle simulation program for the control policy and guideway system as described in the previous study. GRA

N78-16937# San Diego Technology Action Center, Calif. Training Research Lab.
TECHNOLOGY TRANSFER: SCIENCE AND TECHNOLOGY APPLIED TO LOCAL GOVERNMENT NEEDS. NATIONAL SYMPOSIUM ON UTILIZATION OF PEOPLE RELATED RESEARCH DEVELOPMENT TEST AND EVALUATION, RDT AND E
W. Lilly Jul. 1977 52 p refs Symp. held at San Diego, Calif., 14-17 Jun. 1977; sponsored by Navy Personnel
(Grant NSF-ISP74-23795)
(PB-272703/0; NSF/RA-770220) Avail: NTIS HC A04/MF A01 CSCL 05A

The problems and needs of research utilization, principally within the military establishment are assessed. Special attention was given to an assessment of current problems in research utilization; an interchange of information on the state-of-the-art in research utilization both from outside and inside the military services; developing policy recommendations for improving research utilization within the military services; and projecting the parameters of research utilization requirements in and beyond the 1980's. This document contains speeches presented during one session of the symposium which was devoted to Technology Transfer. Topics discussed include: (1) how to improve the planning process to achieve more effective technology transfer; (2) how to achieve a better match of overall city and state requirements and available technology; (3) the priority needs of cities and states; (4) the characteristics of examples of successful technology transfer; and (5) measures to be taken to effect a two-way transfer process. GRA

N78-16938# Stanford Research Inst., Menlo Park, Calif.
TECHNOLOGY ASSESSMENT OF TELECOMMUNICATIONS/ TRANSPORTATION INTERACTIONS. VOLUME 1: INTRODUCTION, SCENARIO DEVELOPMENT, AND POLICY ANALYSIS Final Report
Richard C. Harkness May 1977 195 p refs 3 Vol.
(Contract NSF C-1025; SRI Proj. 4293)
(PB-272694/1; NSF/RA-770157) Avail: NTIS HC A09/MF A01; also available in set of 3 reports HC E17 as PB-272693-SET CSCL 17B

The social, economic, and environmental consequences of changes in the relationships between telecommunications and transportation were analyzed. Scenarios were used to describe these changes. The scenarios were found to have significant implications for energy conservation, urban development, commuting, mass transit, job accessibility for persons unable to commute, communications within organizations, residential locational freedom, the telecommunications industry, the airline industry, and other areas. GRA

N78-16939# Stanford Research Inst., Menlo Park, Calif.
TECHNOLOGY ASSESSMENT OF TELECOMMUNICATIONS/ TRANSPORTATION INTERACTIONS. VOLUME 2: DETAILED IMPACT ANALYSES Final Report
Richard C. Harkness, R. R. Panko, R. Pye, R. M. Tyler, C. C. Cobb, F. E. Gordon, P. G.W. Keen, R. L. Martin, B. L. Walton, M. Duffey-Armstrong et al May 1977 1059 p refs 3 Vol.
(Contract NSF C-1025; SRI Proj. 4293)
(PB-272695/8; NSF/RA-770158) Avail: NTIS HC A99/MF A01; also available in set of 3 reports HC E17 as PB-272693-SET CSCL 17B

Impact analyses and a 1090-entry bibliography are presented. For Vol. 1, see N78-16938. GRA

N78-16940# Stanford Research Inst., Menlo Park, Calif.
TECHNOLOGY ASSESSMENT OF TELECOMMUNICATIONS/TRANSPORTATION INTERACTIONS. VOLUME 3: CONTRIBUTIONS OF TELECOMMUNICATIONS TO IMPROVED TRANSPORTATION SYSTEM EFFICIENCY Final Report
A. E. Moon, J. M. Johnson, E. P. Meko, II, H. S. Proctor, and C. D. Feinstein May 1977 126 p refs 3 Vol.
(Contract NSF C-1025; SRI Proj. 4293)
(PB-272696/6; NSF/RA-770159) Avail: NTIS HC A07/MF A01; also available in set of 3 reports HC E17 as PR-272693-SET CSCL 17B

The use of telecommunications in the transportation industry is discussed for various sectors, and proposals for increased use of telecommunications are also examined and evaluated. Economically justified proposals for new applications will require an investment of about $3 billion over the next 20 years. The justifications for increased use of telecommunications are reduction in personnel needed to operate systems, by use of communications in automation; reductions in the need for equipment, primarily vehicles, through more efficient management of assets; and substitution of telecommunications investment for investment in construction to increase capacity of highways, railways, and airways. GRA

N78-16941# Hoffman Information Identification, Inc., Fort Worth, Tex.
A COMPREHENSIVE FIELD TEST AND EVALUATION OF AN ELECTRONIC SIGNPOST AVM SYSTEM. VOLUME 1: TEST RESULTS Final Report, Sep. 1976 - Mar. 1977 on Phase 1
George W. Gruver Aug. 1977 331 p
(Contract DOT-TSC-1237)
(PB-272907/7; RO-77-0026-Vol-1; UMTA-MA-06-0041-77-8; DOT-TSC-UMTA-77-31/1) Avail: NTIS HC A15/MF A01 CSCL 13F

Activities are described of Phase 1 which involved the installation and test of a H13 AVM System in Philadelphia, Pennsylvania, during the winter of 1976-1977. A summary report on all systems tested is Experiments on four different techniques for automatically locating land vehicles. Phase 1 tests were divided into two primary categories: (1) random-route tests and (2) fixed-route. In the ramdom-route tests, the system showed the capability of locating the vehicle to within 282 feet, at 95 percent of the sample points under a wide range of urban and environmental conditions. In the fixed-route tests, an odometer and 15 signposts provided the vehicle's location to within 105 feet at 95 percent of the sample points along a 13-mile route. The time of passage of designated bus schedule 'timepoint' was automatically determined to within 11 seconds 95 percent of the time. GRA

N78-16942# Dallas Dept. of Water Utilities, Tex.
CONTROL OF SEWER OVERFLOWS BY POLYMER INJECTION Final Report
R. W. Chandler and W. R. Lewis Sep. 1977 182 p refs
(Grant EPA-11020-DZU)
(PB-272654/5; EPA-600/2-77-189) Avail: NTIS HC A09/MF A01 CSCL 13B

A possible alternative system wherein the capacity of a sewer might be increased by the injection of certain water-soluble chemicals to reduce turbulent friction was further developed and demonstrated, in the Bachman Creek sewershed, in Dallas, Texas. The feasibility of using turbulent friction reduction, designing an injection facility, choosing a friction reducing material, and evaluating the results are topics discussed. GRA

N78-16943# Johnson and Anderson, Inc., Pontiac, Mich.
EFFECTS OF FLOW EQUALIZATION ON THE OPERATION

AND PERFORMANCE OF AN ACTIVATED SLUDGE PLANT Final Report
David Blough, Gerald W. Foess, and James G. Meenahan Aug. 1977 110 p refs Prepared in cooperation with Ypsilanti Township, Mich.
(Grant EPA-S-801985)
(PB-272657/8; EPA-600/2-77-138) Avail: NTIS HC A06/MF A01 CSCL 13B

A plant-scale research program was carried out to evaluate the impact of flow equalization on the 14,000 cu m/day upgraded activated sludge plant. Process streams were characterized under both equalized and unequalized flow conditions with respect to BOD, COD, TSS and forms of nitrogen and phosphorus. The equalization system was effective in leveling influent diurnal flow variations but was limited in its ability to dampen variations in wastewater concentration and mass flux. Some biochemical action apparently occurred in the equalization basin, although BOD removal was marginal and inconsistent. Analysis of secondary effluent indicated that plant performance was similar with and without equalized flow, suggesting that the theoretical advantages of flow equalization may not be achieved in manually controlled plants. An examination of theoretical power costs for equalized and unequalized flow conditions indicated that the use of flow equalization did not result in power cost economies. GRA

N78-16944# Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
DUAL MEDIA FILTRATION OF WASTE STABILIZATION POND EFFLUENT
Marvin T. Bond Sep. 1977 63 p refs
(Contract DI-14-34-0001-7052)
(PB-273769/0; W78-00557; OWRT-A-107-Miss(1)) Avail: NTIS HC A04/MF A01 CSCL 13B

Three filter beds were constructed by placing a layer of coal on top of a layer of sand. Filter sands having an effective grain size of 0.2, 0.4 and 0.6 mm were used to pack six inch diameter, plexiglas columns to a depth of 24 inches. All coal media had an effective size of 0.9 mm, a uniformly coefficient of 1.5, and an in-column depth of 6 inches. Filters were operated both with and without the addition of coal to the beds. Maximum removal of suspended solids was approximately 50% for the 0.2 mm effective grain size dual media filters. GRA

N78-16945# Notre Dame Univ., Ind. Dept. of Civil Engineering.
APPLICATION OF SEQUENCING BATCH REACTORS FOR TREATMENT OF MUNICIPAL AND INDUSTRIAL WASTEWATERS Annual Report, 1 Jul. 1976 - 30 Jun. 1977
Robert L. Irvine 1977 146 p refs
(Grant NSF ENV-76-10381)
(PB-273846/6; NSF/RA-770259; AR-1) Avail: NTIS HC A07/MF A01 CSCL 13B

Fill and draw reactors in terms of their applicability to a wide variety of treatment areas were developed. Design and control procedures are presented so that the batch technology developed can be considered by design engineers as a viable option to conventional continuous flow systems for satisfying present and future effluent requirements. The overall objective is to investigate application of controlled, unsteady state operations and processes to treatment of waste water for attainment of better consistency and reliability than is practically possible using conventional steady state methods. User (market) areas were defined which can benefit immediately from the investigations conducted. GRA

N78-16946# Arizona Univ., Tucson.
THE APPLICATION OF TECHNOLOGY IN DEVELOPING COUNTRIES Report, Aug. - Dec. 1976
Robert L. Bulfin, Jr. and J. Richard Greenwall 1977 172 p Presented at Interdisciplinary Programs Seminar Ser., Tucson, Ariz., Aug. - Sep. 1976
(PB-273529/8) Avail: NTIS HC A08/MF A01 CSCL 05A

The varying, and sometimes differing, views of specialists in such fields as industrial, civil, nuclear, agricultural, and systems engineering, physical geography, and cultural anthropology are represented. GRA

N78-16947# BDM Corp., McLean, Va.
A TECHNOLOGY ASSESSMENT OF OFFSHORE INDUSTRY. THE UNITED STATES OFFSHORE INDUSTRY. CURRENT STATUS, TRENDS AND FORECAST 1976 - 2000, VOLUME 1 Final Report
James H. Durfee Aug. 1977 522 p refs 3 Vol.
(Contract MA-5-38024)
(PB-272983/8; BDM/W-77-425-TR-Vol-1; MA-RD-940-78002-Vol-1) Avail: NTIS HC A22/MF A01; also available in set of 3 reports HC E12 as PB-272982-SET CSCL 08I

The current status of the U.S. offshore industry, developing trends in the industry, and the various forces that influence development were discussed. A 25 year forecast of offshore industry development is included. Also included is a description of the U.S. commercial ocean fishing industry and a 25 year forecast of industry development. GRA

N78-16948# BDM Corp., McLean, Va.
A TECHNOLOGY ASSESSMENT OF OFFSHORE INDUSTRY AND ITS IMPACT ON THE MARITIME INDUSTRY 1976 - 2000, VOLUME 2 Final Report
James H. Durfee Aug. 1977 144 p refs 3 Vol.
(Contract MA-5-38024)
(PB-272984/6; BDM/W-77-425-TR-Vol-2; MA-RD-940-78003-Vol-2) Avail: NTIS HC A07/MF A01; also available in set of 3 reports HC E12 as PB-272982-SET CSCL 08I

The various impacts on the traditional maritime industry of offshore industry development, and the areas of planning needed by the maritime industry to accommodate those impacts are described. GRA

N78-16949# BDM Corp., McLean, Va.
A TECHNOLOGY ASSESSMENT OF OFFSHORE INDUSTRY AND ITS IMPACT ON THE MARITIME INDUSTRY 1976 - 2000. EXECUTIVE SUMMARY Final Report
James H. Durfee Aug. 1977 74 p refs 3 Vol.
(Contract MA-5-38024)
(PB-272985/3; BDM/W-77-425-TR; MA-RD-940-78001) Avail: NTIS HC A22/MF A01; also available in set of 3 reports HC E12 as PB-272984 CSCL 08I

Each segment of the offshore industry is described in terms of the current status of industry, trends that might influence the direction of future development, and forces acting on the industry to impede or encourage growth. Potential areas of impact on the maritime industry, such as financial, manpower, environmental, materials requirements, legislation and regulation, and new technologies, that might result from offshore industry development are examined. Changes likely to result in the maritime industry from the various impacts described and planning that will be needed to accommodate to the changes are discussed. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N78-16950 New Mexico State Univ., University Park.
QUANTITATIVE SPECTRAL CLASSIFICATION OF SOLAR-TYPE STARS AND THE SUN Ph.D. Thesis
Harold James Reitsema 1977 112 p
Avail: Univ. Microfilms Order No. 77-25076

Spectroscopic observations of solar-type stars at a dispersion of 40 A/mm are used to derive quantitative indices which are strongly correlated with B-V photoelectric color and absolute

magnitude. For stars which have no peculiarities in their spectra, B-V and Mv indices are determined and used to place a star in the color-magnitude diagram, and the calibration of the diagram in terms of MK spectral type is used to derive the spectral type of the star. Application of MK spectral classification standards in the G0-G5 region indicates that the revised list of Morgan and Keenan is a more self-consistent set of standards than is the list of Johnson and Morgan. Examination of the lunar reflection of the solar spectrum indicates a spectral type of G4V. This result is typical of quantitative spectroscopic classifications of the sun while photoelectric measures of the solar flux are consistent with a solar spectral type of G2V. Dissert. Abstr.

N78-16951 Indiana Univ., Bloomington.
THE CLASSIFICATION AND INTERPRETATION OF S STARS Ph.D. Thesis
John Piccirillo 1977 306 p
Avail: Univ. Microfilms Order No. 77-22668

An 8-color near-infrared photometric system was used to sample the stellar flux of approximately 160 stars of many spectral types to provide a blackbody color temperature, an infrared magnitude (at 1.04 microns), and molecular band strength indices of TiO, VO, ZrO, CN, and an unidentified feature. Based upon this data, classification sub-groups were established with the color temperature and band strengths of TiO and ZrO and used to subdivide the S stars into homogenous groups with respect to their physical variables and to estimate the values of the variables of those sub-groups. Dissert. Abstr.

N78-16952 Michigan State Univ., East Lansing.
RESONANCE LINE FORMATION IN EXPANDING DECELERATING ATMOSPHERES Ph.D. Thesis
Felix Marti 1977 120 p
Avail: Univ. Microfilms Order No. 77-25260

The formation of resonance lines in a stellar atmosphere that is expanding but decelerating, or infalling and accelerating as it falls in was studied. Spherical geometry was considered, and the supersonic approximation with complete redistribution over the line profile in the fluid frame was assumed. Various layers in the atmosphere become radiatively coupled or interconnected, because of Doppler shifts and effects of the projection of the velocity on the ray direction. The line profiles show sharper and sharper peaks as the outer cutoff radius is increased, or the velocity law is steepened. It is possible to obtain profiles with as sharp a drop-off at the blue of the peak as is seen in the QSO PHL 5200. Dissert. Abstr.

N78-16953 Pittsburgh Univ., Pa.
AN ASTROMETRIC STUDY OF THE ECLIPSING BINARY 31 o2 CYGNI Ph.D. Thesis
Lee Allen Breakiron 1977 385 p
Avail: Univ. Microfilms Order No. 77-23601

The astrometric and spectroscopic orbits of 31 o2 Cygni were studied to derive the distance, masses, and luminosities of the components. The theory of visual, astrometric, and spectroscopic orbital solutions is discussed and a rigorous method of combining such data while introducing no spurious accelerations is presented, as well as the data, computer programs, and reductions. Dissert. Abstr.

N78-16954 Illinois Univ., Urbana-Champaign.
STUDIES OF RADIO RECOMBINATION LINES TOWARD ORION A AND W49B Ph.D. Thesis
Willis Lee Boughton 1977 177 p
Avail: Univ. Microfilms Order No. 77-26635

Observations of the C168alpha, C211beta, C126alpha, and C111alpha recombination lines toward the HII region Orion A are consistent with the previously-proposed hypothesis that two distinct regions contribute to the carbon-line emission. One of these regions appears to be a CII/HI transition zone located at the interface of the HII region and the molecular cloud which is located behind the HII region, while the other carbon-emitting region appears to be associated with the HI clouds observed in 21 cm (hydrogen-hyperfine) absorption measurements. Observations of the H167alpha, H166alpha, H126alpha, and H92alpha recombination lines toward the SNR W49B and the H166alpha line toward the nearby HII region W49A confirm the presence of line emission at v approximates 60 km/s toward both the SNR and the HII region. Dissert. Abstr.

N78-16955 Michigan Univ., Ann Arbor.
H AND K WING EMISSION LINES IN LATE-TYPE STARS Ph.D. Thesis
Robert Edward Stencil 1977 201 p
Avail: Univ. Microfilms Order No. 77-26369

The observation, empirical properties and interpretation, of spectral emission lines from metals and rare-earth elements which occur in the extensive wings of the resonance lines of singly-ionized calcium among cool stars were studied. The observations are discussed in terms of a study of nearly 1000 high-dispersion spectrograms of over 225 stars of spectral types F2 to M6 and all luminosity classes. It is concluded that the H-K wing emission lines do occur frequently among cool luminous stars, and the strength of their appearance is dependent on stellar luminosity aand possibly on atmospheric effects that asymmetrize the central emission profiles of the Ca II H and K lines. Dissert. Abstr.

N78-16956*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Dept. of Physics.
ONE-MILLIMETER BRIGHTNESS TEMPERATURES OF THE PLANETS
M. W. Werner (Hale Observatories), G. Neugebauer (Hale Observatories), J. R. Houck (Cornell Univ., Ithaca, N. Y.), and M. G. Hauser [1978] 21 p refs
(Grant NGL-05-002-207)
(NASA-TM-74989) Avail: NTIS HC A02/MF A01 CSCL 03A

New values for the 1 mm brightness temperatures of Mercury, Venus, Jupiter, Saturn, Uranus and Neptune were determined using Mars as the absolute photometric standard. Author

N78-16957# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MAGNITUDES OF STARS ON THE S-20 SYSTEM
John M. Sorvari 14 Sep. 1977 25 p ref
(Contract F19628-76-C-0002)
(AD-A047099; ETS-19; ESD-TR-77-231) Avail: NTIS HC A02/MF A01 CSCL 03/2

An S-20 magnitude system is defined, and a relation between it and B, V-photometry is established. A catalog of m sub v, (B-V), and m sub 20 for 323 stars is given. GRA

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N78-16958 Arizona Univ., Tucson.
RADIO AND OPTICAL PROPERTIES OF DOUBLE GALAXIES Ph.D. Thesis
John Thomas Stocke 1977 161 p
Avail: Univ. Microfilms Order No. 77-24943

The basic radio and optical properties of a large, well-defined, complete sample of isolated pairs of galaxies in some of the sparsest regions of space were studied. Due to this selection criterion the sample is approximately 75% spirals. A radio continuum survey of the entire sample of 1206 galaxies was accomplished at 2695 MHz on the 91 meter telescope. Follow-up observations to obtain additional information on detected sources used a 43 meter telescope at 5GHz and an interferometer. Due to the depth of the sample in space the detected galaxies are either elliptical radio galaxies or the strongest spiral radio sources. Only a few of the closest spirals were detected at the low power levels consistent with typical disk emission. Two general models are suggested by the results. Either galaxy fissions are involved or mass transfer exists between galaxies or from the integalactic medium onto a galaxy. Dissert. Abstr.

N78-16959 California Univ., Los Angeles.
ON THE MAGNITUDE DISTRIBUTION OF FIELD GALAXIES Ph.D. Thesis
George William Rainey, Jr. 1977 169 p
Avail: Univ. Microfilms Order No. 77-23916

Photoelectrically calibrated photographic photometry was used

to obtain approximately 3100 measurements down to V = 20 in three regions of the galaxian field of approximately one square degree each, selected away from known rich clusters of galaxies. An attempt is made to reconcile the observed magnitude distribution of the field with both cosmological models and the intrinsic luminosity function for field galaxies. Although the field galaxy luminosity function does not appear to be too different from that for rich clusters, the spiral galaxy content of the field is considerably greater, the field galaxy apparent visual magnitude distribution is given in the form of the slope of the logarithmic integrated counts as a function of visual magnitude. The field correction for cluster photometry is then illustrated by an application to Abell Cluster 2670. Dissert. Abstr.

N78-16960 California Univ., Los Angeles.
THE STRUCTURE OF THE VIRGO REGION OF GALAXIES Ph.D. Thesis
Thomas Stephen Eastmond 1977 286 p
Avail: Univ. Microfilms Order No. 77-23851

The critical distance, luminosity m and radial velocity of individual stars or clusters in the Virgo region of galaxies were determined. Based upon considerations of distance indicators, radial velocities, and mass/light ratios, the most likely model for the central condensation places the spiral and elliptical systems at the same mean distance. Dissert. Abstr.

N78-16961 Texas Univ., Austin.
A MODEL OF SUPERDENSE MATTER AND ITS APPLICATION TO NEUTRON STARS Ph.D. Thesis
Robert Daryl Pedigo 1977 184 p
Avail: Univ. Microfilms Order No. 77-23014

A phenomenological model of superdense baryonic matter at zero temperature was developed and the resulting equation of state employed in the calculation of neutron star masses and moments of inertia. The two parameters in the model, the coupling strengths, are fixed by the requirement that the accepted binding energy of infinite nuclear matter be reproduced at nuclear density. These couplings are used to calculate a forward proton-neutron cross section. A pressure-energy density equation of state is generated for an electrically neutral system of electrons, muons, and the lowest mass baryon octet. The constituents are held in chemical equilibrium by the weak interactions. The equation of state exhibits a broad phase transition encompassing nuclear density, which leads to neutron stars containing a nearly incompressible core surrounded by a significantly less dense shell. Dissert. Abstr.

N78-16962 Iowa Univ., Iowa City.
THE DYNAMICAL EVOLUTION OF GAS CLOUDS UNDERGOING RADIATIVE ACCELERATION NEAR COMPACT LUMINOUS OBJECTS Ph.D. Thesis
Michael Robert Haas 1977 305 p
Avail: Univ. Microfilms Order No. 77-25988

A two-dimensional, gasdynamic computer code is used to study the evolution of gas clouds undergoing radiative acceleration in the presence of a confining medium. The initial clouds have uniform density and temperature, are approximately spherical in shape, and are in photoionization equilibrium with the central, nonthermal source of radiation. Parameters are chosen so that the clouds are optically thin. Adiabatic heating and cooling are included; the effects of line cooling are discussed. The clouds are either given an initial velocity such that the ram pressure of a relatively cool external medium balances their internal gas pressure, or the external temperature is chosen high enough so that the clouds are thermally continued. Dissert Abstr.

N78-16963*# Stanford Univ., Calif. Inst. for Plasma Research.
RADIATIVE TRANSFER IN DUSTY NEBULAE
Roger Alan Dana Nov. 1977 139 p refs
(Grant NGR-05-020-510; NCA2-OR745-715)
(NASA-CR-155580; SU-SUIPR-722) Avail: NTIS HC A07/MF A01 CSCL 03B

The effects of dust scattering on observable optical and infrared parameters, and the accuracy of approximate solutions were examined. The equation of radiative transfer in a static and homogeneous, but not necessarily uniform, distribution gas and dust around a central empty core with a point source of energy at its center was solved. The dust properties were characterized by a phenomenological extinction cross section, albedo and parameters describing the anisotropy of dust scattering. For ultraviolet photons, ionization equilibrium equations for the gas were solved, and for infrared photons a self-consistent dust temperature was calculated. Ray tracing was used to solve for the angular dependence of the intensity. Author

N78-16964# Los Alamos Scientific Lab., N. Mex.
DYNAMICAL ZONING WITHIN A LAGRANGIAN MESH BY USE OF DYN, A STELLAR PULSATION CODE
John Castor (Colo. Univ., Boulder), Cecil G. Davis, and David K. Davison (Calif. Univ., Santa Cruz) Feb. 1977 33 p refs
(Contract W-7405-eng-36)
(LA-6664) Avail: NTIS HC A03/MF A01

A method of dynamical zoning within a Lagrangian mesh is used to resolve the motion of the hydrogen ionization front in a time-dependent nonlinear model of a pulsating star. The resulting coupling with the radiative transfer improves the calculated light curves. The method is described in some detail and then applied to a model of the Cepheid eta Aq1. ERA

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N78-16965 California Univ., Los Angeles.
IMPACT PHENOMENA ON THE TERRESTRIAL PLANETS Ph.D. Thesis
John Dugan OKeefe 1977 190 p
Avail: Univ. Microfilms Order No. 77-23909

A theoretical understanding is provided of flows induced into geologic materials upon meteoroid impact at velocities appropriate to collisions in the zone of terrestrial planets. These results are meant to provide a basis for interpreting the features associated with meteorite impact craters and their ejecta distributions on the terrestrial planets, as well as to provide some insights into the late stages of planetary accretion. The problem of computing the initial one dimensional shock states associated with different velocity impacts was addressed and the impact velocities required for melting and vaporization were determined for a number of minerals and rocks. The problem of computing impact-induced flows was also examined.
Dissert. Abstr.

N78-16966 Pittsburgh Univ., Pa.
OPTICAL ABSORPTION BANDS IN GLASSES OF LUNAR COMPOSITION Ph.D. Thesis
Eddie Neil Wells 1977 183 p
Avail: Univ. Microfilms Order No. 77-23587

In order to improve remote sensing techniques for observations of the moon and planets, a study was made of optical absorption bands of iron and titanium in glasses of lunar composition. A number of glasses were made under reducing and oxidizing conditions with compositions varying over the entire range of lunar sample compositions. Reflectivity spectra were studied for glasses similar in composition to all major lunar rock types, and all were found to exhibit a visible window and strong, broad absorption bands at 0.42, 1.1, and 1.9 micrometers. The spectra closely match spectra of actual and synthetic lunar glasses but did not match the spectra of the dark glasses. An important result of this study was the confirmation of the predicted band positions of ligand-metal charge transfer bands of iron and titanium from molecular orbital theory. Dissert. Abstr.

N78-16967 Arizona Univ., Tucson.
TECTONISM AND THE INTERIOR OF MERCURY Ph.D. Thesis
Bruce Monteith Cordell 1977 135 p
Avail: Univ. Microfilms Order No. 77-26957

The surface expressions of global tectonism on Mercury were investigated and their implications for the planet's interior were explored. The Mariner 10 spacecraft imagery revealed two systems of globally distributed lineaments: the lobate escarpments and the lunar-like lineaments. Superposition relations suggest that the lineaments were formed pre-Caloris, and the lineaments were formed prior to the scarps. The fairly uniform, global distribution of scarps indicates that their generating stress field was also global in influence. The random nature of scarp trends suggests that planetary contraction was responsible for these features. Dissert. Abstr.

N78-16968 Wisconsin Univ., Madison.
MODEL PLANETARY NEBULAE: THE EFFECT OF SHADOWED FILAMENTS ON LOW IONIZATION POTENTIAL ION RADIATION Ph.D. Thesis
Andrew Katz 1977 113 p
Avail: Univ. Microfilms Order No. 77-17836

Radial filaments are shielded from the direct stellar ionizing radiation by optically thick condensations in the nebula. Because the only source of ionizing photons in the shadowed filaments is due to diffuse photons produced by recombination, ions of lower ionization potential are expected to exist there in greater numbers than those found in the rest of the nebula. This leads to increased line strengths from these ions and increases their values to match the observational values. These line strengths in the filaments increase by over one to two orders of magnitude relative to values found in homogeneous models. This results in an increase of approximately one order of magnitude for these lines when contributions from both components of the nebula are considered. The parameters that determine the exact value of the increase are the radial location of the filaments in the nebula and the fraction of the nebular volume occupied by the filaments. Dissert. Abstr.

N78-16969 Yale Univ., New Haven, Conn.
THE COSMOCHEMICAL HISTORY OF THE PALLASITES Ph.D. Thesis
Andrew Morgan Davis 1977 298 p
Avail: Univ. Microfilms Order No. 77-27808

The pallasites are a relatively rare type of meteorite containing approximately equal amounts of olivine [(Mg, Fe)2SIO4] (FA12 to 20) and iron-nickel (8 to 16% Ni), with minor amounts of troilite [FeS,] schreibersite [FE,NI)3P] and chromite [FECR2O4]. The origin of the pallasites has intrigued investigators since the discovery of the Pallas Iron (now known as the Krasnojarsk pallasite) in 1749. The unique texture and slow cooling rates of the pallasites lead several authors to suggest that the pallasites were formed deep within one or more small parent planets. A systematic study of the trace element abundances of the pallasites was undertaken with the goal of determining which chemical fractionation processes have affected pallasite compositions. In order to delineate these processes, fourteen elements with a wide variety of chemical and physical properties, Ni, Co, Cu, Ga, Ge, As, Ru, Pd, W, Re, Os, Ir, Pt and Au, were determined in the metal phase, and six elements, Na, Sc, Cr, Mn, Fe and Co, were determined in the olivine phase of thirty-one of the fifty-one known pallasites. Dissert. Abstr.

N78-16970 Oregon Univ., Eugene.
THE PETROGENESIS OF TITANIUM-RICH BASALTS FROM THE LUNAR MARIA AND OF KREEP-RICH ROCKS FROM THE LUNAR HIGHLANDS Ph.D. Thesis
Gordon Alan McKay 1977 243 p
Avail: Univ. Microfilms Order No. 77-19347

The results of an experimental study of the crystallization of high-Ti mare basaltic compositions, and the application of these results to several aspects of mare basalt petrogenesis are presented. Crystallization experiments were performed over a temperature range spanning almost the entire crystallization interval of the compositions studied, and over a range of oxygen fugacities spanning four orders of magnitude (at any particular temperature) and bracketing probable lunar fugacities. Compositions and relative proportions of all coexisting phases in the resulting quenched charges are reported. Experimentally determined solid/liquid distribution coefficients for a number of trace elements for olivine, orthopyroxene, plagioclase, and ilmenite and the application of these coefficients to the petrogenesis of the suite of trace element enriched highlands rocks known as KREEP were reviewed. Dissert. Abstr.

N78-16971*# Arizona Univ., Tucson. Electrical Engineering Dept.
DETECTION TECHNIQUES FOR TENUOUS PLANETARY ATMOSPHERES Progress Report, 1 Jul. - 31 Dec. 1977
Stuart A. Hoenig Jan. 1978 25 p refs
(Grant NGL-03-002-019)
(NASA-CR-155523; PR-29) Avail: NTIS HC A02/MF A01 CSCL 03B

The application of detectors developed for analysis of planetary atmospheres under partial vacuum conditions, and data obtained during dust charging studies to various industrial problems is summarized. A specialized apparatus for dust measurements on a planetary lander was designed with the capability of measuring ambient dust density as a function of particle size, as well as for observing the charge of the collected dust. the optical system operates on an intermittent basis and requires only low power. No radioactive source or delicate detection equipment is required. Advances in monitoring catalyst operation by means of exoelection emission are also reported. A.R.H.

N78-16972*# Martin Marietta Labs., Baltimore, Md.
PETROGRAPHIC AND PETROLOGICAL STUDY OF LUNAR ROCK MATERIALS Final Report, 5 May 1976 - 5 May 1977
Stephen R. Winzer 5 May 1977 129 p refs
(Contract NAS5-23544)
(NASA-CR-156670) Avail: NTIS HC A07/MF A01 CSCL 03B

Impact melts and breccias from the Apollo 15 and 16 landing sites were examined optically and by electron microscope/microprobe. Major and trace element abundances were determined for selected samples. Apollo 16 breccias contained impact melts, metamorphic and primary igneous rocks. Metamorphic rocks may be the equivalents of the impact melts. Apollo 15 breccias studied were fragment-laden melts derived from gabbro and more basalt target rocks. Author

N78-16973*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SUMMER WORKSHOP ON NEAR-EARTH RESOURCES
James B. Arnold, ed. (Calif. Univ., La Jolla) and Michael B. Duke, ed. Jan. 1978 107 p refs Workshop held at La Jolla, Calif., 6-13 Aug. 1977
(NASA-CP-2031; S-482; JSC-13139) Avail: NTIS HC A06/MF A01 CSCL 03B

The possible large scale use of extraterrestrial resources was addressed, either to construct structures in space or to return to Earth as supplements for terrestrial resources. To that end, various specific recommendations were made by the participants in the summer study on near-Earth resources, held at La Jolla, California, 6 to 13 August, 1977. The Moon and Earth-approaching asteroids were considered. Summaries are included of what is known about their compositions and what needs to be learned, along with recommendations for missions designed to provide the needed data. Tentative schedules for these projects are also offered. Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N78-16974 Colorado Univ., Boulder.
A STUDY OF METER WAVELENGTH CONTINUUM RADIATION FROM THE SUN Ph.D. Thesis
Richard David Robinson, Jr. 1977 333 p
Avail: Univ. Microfilms Order No. 77-24277

Solar continuum radiation at metric wavelengths, occurring in a wide variety of forms, was studied. The three types of continuum radio bursts most closely related to the flare event were primarily considered with the principal objective understanding the dynamics of the radio events, the radio emission mechanism and the physical properties of the corona. Radio

observations of the continuum events were obtained using the Culgoora radioheliograph, while synchrotron and Langmuir wave emission processes under coronal conditions were studied.
Dissert. Abstr.

N78-16975 Colorado Univ., Boulder.
A THREE-DIMENSIONAL MODEL OF HIGH-SPEED STREAMS IN THE SOLAR WIND Ph.D. Thesis
Victor John Pizzo 1977 291 p
Avail: Univ. Microfilms Order No. 77-24270

Recent observations of coronal structure, together with statistical inferences drawn from spacecraft data, strongly suggest that the solar wind flow is organized in large-scale three-dimensional (3-D) patterns. A single fluid, nonlinear, adiabatic, 3-D, hydrodynamic numerical model for supersonic corotating streams in the region r greater than 35 solar radii was developed. Of primary concern is the extent to which nonlinear effects and the internally-generated nonradial flow may influence the dynamics and evolution of a stream in the supersonic region. To isolate these phenomena, theoretical predictions of the full two dimensional description are compared with those of simpler linear and purely radial formulations. Dissert. Abstr.

N78-16976 Colorado Univ., Boulder.
AN OBSERVATIONAL INVESTIGATION OF LONG PERIOD OSCILLATIONS IN THE APPARENT SOLAR DIAMETER Ph.D. Thesis
Timothy McCain Brown 1977 114 p
Avail: Univ. Microfilms Order No. 77-24191

A power spectrum analysis of eleven individual time series observations of the apparent solar diameter reveals oscillations throughout the three minute to 70 minute period range, with typical amplitudes of .000002 of the solar diameter. Many of the long period peaks in the power spectrum appear to be narrow-band features, with damping times long compared to the length of a typical time series. At least ten of the observed peaks show repeatable power levels that are significant at the 0.999 confidence level, and two of them appear to show good phase coherence over the entire 30 day observation period.
Dissert. Abstr.

N78-16977*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVATIONS OF SOLAR ACTIVE REGIONS AND SOLAR FLARES BY OSO-7
W. M. Neupert Dec. 1977 26 p refs Presented at the OSO Workshop, Boulder, Colo., 8 Nov. 1977
(NASA-TM-78043) Avail: NTIS HC A03/MF A01 CSCL 03B

Contributions made to the physics of coronal active regions and flares by the extreme ultraviolet and soft X-ray spectroheliograph on OSO-7 were discussed. Coronal structures above active regions were discussed from the point of view of their morphology and physical properties, including their relationship to photospheric and coronal magnetic fields. OSO-7 also recorded flares with sufficient spatial and temporal resolution to record, in some instances for the first time, the extreme ultraviolet and soft X-ray emission associated with such chromospheric phenomena as filament activation and the emergence of satellite sunspots. Flare phenomena were reviewed in terms of the several stages of evolution typically associated with the event. Author

N78-16978# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 390, SUPPLEMENT
Feb. 1977 90 p refs
(PB-273209/7; SGD-390-Suppl; NOAA-77090711) Avail: NTIS HC A05/MF A01 CSCL 03B

A description and explanation of the data in the monthly publication, Solar-Geophysical Data is presented. Solar-Geophysical Data is intended to keep research workers abreast on a timely schedule of the major particulars of solar activity and the associated interplanetary, ionospheric, radio propagation and other geophysical effects. GRA

N78-16979# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 390, FEBRUARY 1977. PART 1 (PROMPT REPORTS): DATA FOR JANUARY 1977, DECEMBER 1976
Hope I. Leighton Feb. 1977 122 p
(PB-273185/9; SGD-390-Pt-1; NOAA-77090709-Pt-1) Avail: NTIS HC A06/MF A01 CSCL 03B

Data are provided for January 1977 on: alert periods, daily solar indices, solar flares, solar radio waves, solar X-ray radiation, coronal holes, inferred 1P magnetic field polarities, mean solar magnetic fields, and solar wind measurements. Also provided are data for December 1976 on: daily solar activity centers, sudden ionospheric disturbances, solar radio waves, cosmic rays, geomagnetic indices, and radio propagation indices. GRA

N78-16980# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 390, FEBRUARY 1977. PART 2 (COMPREHENSIVE REPORTS): DATA FOR AUGUST 1976, JULY 1976, AND MISCELLANEA
Hope I. Leighton Feb. 1977 48 p
(PB-273186/7; SGD-390-Pt-2; NOAA-77090710-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 03B

Data are provided on: active regions, synoptic solar maps, solar flares, solar radio waves, energetic solar particles and plasma, synoptic chart, abbreviated calendar record, and regional flare index. GRA

N78-16981# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
A COMPILATION OF SOLAR FLARES REPORTED DURING THE SKYLAB MISSION
Joseph Hirman, Robert Losey, and Gary Heckman Aug. 1977 68 p
(PB-273613; NOAA-TM-ERL-SEL-49; NOAA-77092210) Avail: NTIS HC A04/MF A01 CSCL 03B

Solar flares reported from visual observations in real time and from film reviews for the Skylab period are listed in conjunction with their X ray activity. Summaries of activity are listed by both Boulder and McMath region numbers, and also a cross-reference of the Boulder, McMath, and Mt. Wilson region numbers is given. This compilation consists of all the observations of flare activity reported for the period 1 May 1973 to 28 Feb. 1974 both from visual observations reported in real time and from film reviews. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N78-16982 Clarkson Coll. of Technology, Potsdam, N.Y.
COSMIC RAY PROTONS AND DEUTERONS IN THE EARTH'S ATMOSPHERE Ph.D. Thesis
Stephen Michael Yushak 1977 221 p
Avail: Univ. Microfilms Order No. 77-21942

The differential intensity of protons and deuterons in the atmosphere at Fort Churchill, Canada were measured during the summer of 1971 with a balloon-borne dE/dx-E telescope. The telescope was capable of resolving isotopes of hydrogen in the energy interval from 35 to about 160 MeV for protons and from 48 to 215 MeV for deuterons. By using a NaI-detector in conjunction with the E-detector, it was possible to extend the proton spectrum up to 1 GeV. The primary proton spectrum at the top of the atmosphere was derived from the total intensity at 3.1 gm/cm2 and is in agreement with satellite measurements. This agreement suggests that the method used to evaluate the secondary contribution at 3.1 gm/cm2 and other depths is adequate to explain the overall variations of the secondary proton intensity in the atmosphere. Dissert. Abstr.

N78-16983 Case Western Reserve Univ., Cleveland, Ohio.
MEASUREMENT OF 10 MeV ATMOSPHERIC GAMMA RAYS AT A HIGH MAGNETIC LATITUDE Ph.D. Thesis
John Stephen Vogel 1977 195 p

The response of a high energy neutron detector to gamma rays is described, and the results of using this detector to measure secondary photons near the top of the atmosphere at 0.4 Gv geomagnetic cutoff is given. The balloon-borne spark chamber and time of flight system was found to be sensitive to gamma rays of 2 to 20 MeV. The energy and direction of the incident photon were determined from a Compton interaction. The energy and direction of the recoil electron were found from its track in the polyethylene plate spark chamber and the direction of the scattered photon was recorded by a hodoscope array of scintillator blocks. A time of flight measurement assured that the hodoscope was triggered by a photon. Dissert. Abstr.

N78-16984*# California Inst. of Tech., Pasadena.
AN INVESTIGATION OF TECHNIQUES FOR THE MEASUREMENT AND INTERPRETATION OF COSMIC RAY ISOTOPIC ABUNDANCES Ph.D. Thesis
Mark Edward Wiedenbeck 9 Dec. 1977 243 p refs
(Grant NGR-05-002-160)
(NASA-CR-155562; SRL-77-8) Avail: NTIS HC A11/MF A01 CSCL 03B

An instrument, the Caltech High Energy Isotope Spectrometer Telescope was developed to measure isotopic abundances of cosmic ray nuclei by employing an energy loss - residual energy technique. A detailed analysis was made of the mass resolution capabilities of this instrument. A formalism, based on the leaky box model of cosmic ray propagation, was developed for obtaining isotopic abundance ratios at the cosmic ray sources from abundances measured in local interstellar space for elements having three or more stable isotopes, one of which is believed to be absent at the cosmic ray sources. It was shown that the dominant sources of uncertainty in the derived source ratios are uncorrelated errors in the fragmentation cross sections and statistical uncertainties in measuring local interstellar abundances. These results were applied to estimate the extent to which uncertainties must be reduced in order to distinguish between cosmic ray production in a solar-like environment and in various environments with greater neutron enrichments. Author

N78-16985# National Oceanic and Atmospheric Administration, Boulder, Colo.
COLLECTED DATA REPORTS FOR STIP (STUDY OF TRAVELING INTERPLANETARY PHENOMENA) INTERVAL 2, 20 MARCH - 5 MAY 1976
Helen E. Coffey and John A. McKinnon Aug. 1977 325 p refs
(PB-273167/7; UAG-61) Avail: NTIS HC A14/MF A01 CSCL 03B

Significant solar-terrestrial events that occurred during the retrospective world interval are summarized. Phenomena discussed include: (1) solar activity during the period 20-23 March 1976 from a region behind the eastern limb of the sun; (2) a large geomagnetic storm with intense midlatitude auroral activity of 26 March; (3) moderate solar particle intensities at the Earth from 26 through 31 March; and (4) a ground-level solar cosmic ray event on 30 April having a very hard spectrum. GRA

99 GENERAL

No abstracts in this category.

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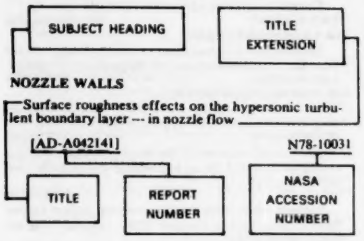

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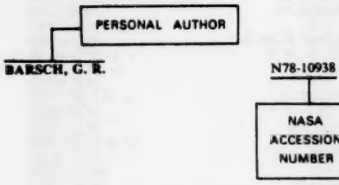

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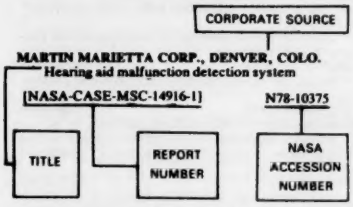

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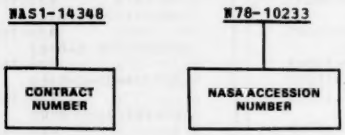

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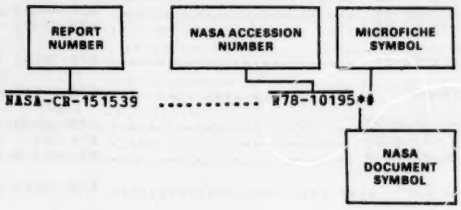

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